US AMPHIBIOUS TANKS OF WORLD WAR II

STEVEN J. ZALOGA ILLUSTRATED BY HENRY MORSHEAD

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NEW VANGUARD • 192

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US AMPHIBIOUS TANKS OF WORLD WAR II

INTRODUCTION

Amphibious assaults played a vital role in the World War II campaigns in both the European and Pacific theaters, and tanks offered an important offensive punch during these landings. Schemes to build American amphibious tanks started in the 1920s, but no practical designs emerged until the war years. US development took two tracks: the addition of guns and light armor to the Navy's amphibious tractors, and the conversion of standard tanks into amphibious tanks. The history of US amphibious tractors has already been detailed in a previous Osprey New Vanguard[1], so this book focuses on the later type of amphibious tank. Initial US Army efforts in 1942 focused on the development of "deep-wading kits," which allowed tanks to drive to the beach while partially submerged. The deep-wading tanks were first used in November 1942 during the Operation *Torch* landings in North Africa. This became the most common US approach to landing tanks and was extensively used in the Mediterranean, European, and Pacific theaters in 1943–45. The predominant British influence on planning for the June 1944 Normandy landings prompted the manufacture of the Duplex Drive (DD) tank conversions in the United States. The DD tank proved to be too fragile in rough seas and led to heavy losses on D-Day. As an alternative to the DD tanks, the US Army developed several alternative swimming tanks. The most successful was the T6 Device that was first used during the Okinawa landings in April 1945; it would have been used in far more substantial numbers had the US invaded Japan in

1 Zaloga, Steven, *Amtracs: US Amphibious Assault Vehicles*, Osprey New Vanguard 30 (1999)

BELOW LEFT
The US Army's most controversial amphibious tank of World War II was the DD tank, converted at Firestone's Ohio plant based on British plans. This shows one of the early production tanks with the screen half retracted. (Patton Museum)

BELOW RIGHT
The Combined Wheel, Caterpillar and Self-propelled Floating Type 75mm Gun Motor Carriage Model 1922 was the second attempt by J. Walter Christie to develop an amphibious tank. After trials at Aberdeen Proving Ground, it was rejected for Army use as unseaworthy. After rebuilding a third time, it was tested and rejected by the Marine Corps. (NARA)

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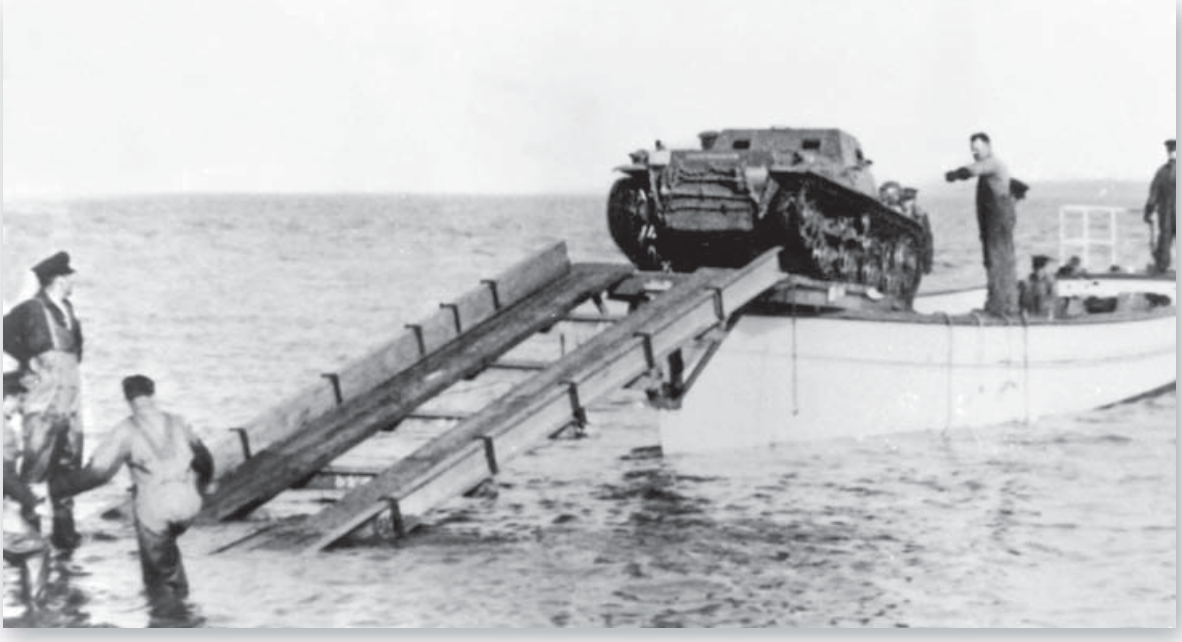
1945–46. Besides the amphibious tanks developed for ocean landings, the US Army also experimented with a number of schemes for river-crossing operations.

EARLY AMERICAN AMPHIBIOUS TANKS

The first serious attempt to develop an amphibious tank in the United States was undertaken as a private commercial venture by the eccentric inventor J. Walter Christie. In June 1921 his prototype amphibian tank was built at the Sun Shipbuilding Company in Chester, Pennsylvania. It was protected with quarter-inch armor and weighed about 6 tons. Like other Christie designs, it featured a "convertible" suspension that could be propelled by wheels or tracks. The initial version was not entirely satisfactory and was rebuilt in 1922 as the "Combined Wheel, Caterpillar and Self-propelled Floating Type 75mm Gun Motor Carriage." It was re-armed with a French M.1897 75mm gun, causing its weight to rise to 7 tons. The US Army tested this vehicle at Aberdeen Proving Ground, Maryland (APG) in 1922, but it failed to spark any interest. This version was not particularly seaworthy, so Christie rebuilt it a third time in November 1923, raising the sides for greater buoyancy and increasing the suspension from three to four wheels per side. To reduce the weight, the large 75mm gun was dropped in favor of a puny 37mm infantry gun. Christie staged public demonstrations in the Hudson River near New York and in the Potomac near Washington DC. Christie corresponded with Brigadier General Smedley Butler of the Marine Corps Expeditionary Force and the tank was tested during the 1924 fleet maneuvers off the Puerto Rican coast at Culebra Island, and launched from a surfaced submarine. The Marines found that the concept was interesting, but that the vehicle was neither seaworthy nor sufficiently armored.

In the late 1930s the Marines re-examined the possibility of using tanks to reinforce beach assaults. The Marmon-Herrington CTL-3 light tank was acquired from 1937 since it was light enough that it could be carried to shore in existing lighters. The Marines also began to experiment with the idea of delivering it from offshore after fitting it with pontoons on either side.



The US Marine Corps began adopting the small Marmon-Herrington CTL-3 light tank in 1937 because it was light enough to be lifted by existing ship cranes for transport ashore in lighters. This is an early experiment in the delivery of tanks ashore using the "Boat Rig A," a primitive predecessor to later LCM (Landing Craft Mechanized). (NARA)

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The Marine Corps conducted experiments to convert the CTL-3 into an amphibious tank using pontoons on the side. This never proved entirely practical and the scheme was abandoned. (NARA)

The pontoon concept was too slapdash, and the Marines favored the use of the new Higgins lighter, a predecessor to the later Landing Craft Mechanized (LCM) fitted with a forward drop-ramp. It could deliver two Marmon-Herrington tanks to shore without the need for any specialized equipment. By the late 1930s, Marine attention was also turning to the new Roebling amphibious tractor (amtrac), an unarmored, tracked amphibian that could deliver troops or supplies ashore. These were put into production at Food Machinery Corporation (FMC) in California shortly before the outbreak of the Pacific War.

In April 1941 the War Department's Office of Scientific Research and Development began to study ways to land tanks ashore in conditions where landing craft were not viable. American officials were in discussions with British officials on this subject, and were shown the Straussler apparatus, an early version of the design that would emerge later as the Duplex Drive tank. On June 11, 1942 a formal project was begun based on this concept with the M3E4 light tank. This used a collapsible canvas screen that was elevated with a set of inflatable tubes. Unlike the later DD tanks, it was propelled in the water using ordinary outboard motors on either side of the erected screen. A prototype was completed by Studebaker Corporation in September 1942 and the tank was tested in Lake Michigan. The design was not especially robust, and the project was cancelled in November 1942.

In the meantime, Ordnance started work on another alternative, the T10 Light Tank (Amphibian). This was a 13-ton light tank fitted with pontoons on the side for buoyancy and propelled in the water by two rear-mounted propellers. The project was assigned to FMC Corporation in December 1941 but the contract was cancelled in April 1942 before the design work was completed. By this time, the FMC amtrac design was already well underway, and interest had shifted to fitting a light tank turret on an amtrac hull. This would eventually enter production in December 1943 as the LVT(A)-1 amphibious tank.

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The only US Army custom-built amphibious tank project was the short-lived T10 Light Tank (Amphibian). The side pontoons folded upward when not in use to reduce the tank's width. The program was cancelled in early 1942 before proceeding to the pilot stage. (Author's collection)

By 1942 both the Army and Marine Corps had largely abandoned any serious interest in amphibious tanks on the presumption that new Navy landing craft would allow tanks to be delivered directly to shore. The new LCM-3 tank lighter could deliver a single medium tank to shore, and the new Landing Craft Tank (LCT) could deliver five medium tanks. These were intended for ship-to-shore transport. For delivering tanks from shore-to-shore, the much larger Landing Ship Tank (LST) was under development and would see its debut in July 1943 in the Operation *Husky* landings on Sicily.

Although the availability of landing craft lessened the requirement for swimming tanks, attention had to be paid to landing the tanks from the craft into the water. In many cases, sandbars or other obstructions were likely to prevent the landing craft from delivering the tank directly onto dry land, so steps had to be taken to prepare the tanks to wade ashore through the surf. Methods had to be found to prevent the water from short-circuiting the tank's electrical system or flooding the engine. This effort was undertaken in a secret program begun by Ordnance at APG in July 1942 under the codename Blue Freeze. The Blue Freeze program included a process of waterproofing the tanks as much as possible to prevent water entering the hull, and adding deep-wading trunks to the air intakes, which would permit tanks to wade to shore in depths up to the tank turret roof. Trials began at APG in the summer of 1942 from a boat dock on the Chesapeake Bay and then in September 1942 to Navy facilities near Norfolk for trials of both light and medium tanks from LCTs.

Britain was working on wading kits in the same timeframe, and used them during the Dieppe raid in August 1942, fitted to Churchill tanks.

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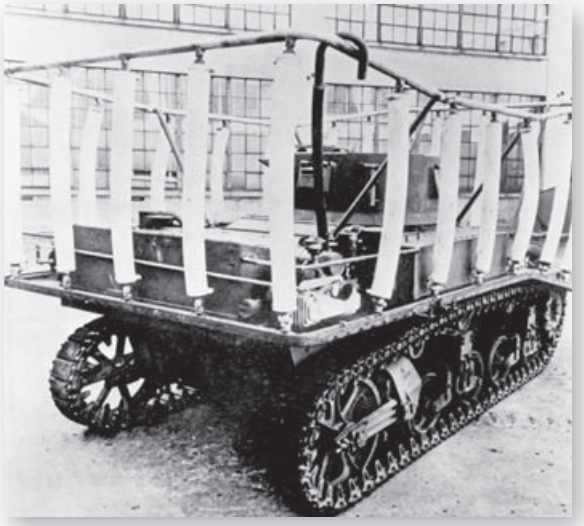

ABOVE LEFT
The US Army began to adapt the British Straussler Apparatus to the M3 light tank under the M3E4 program. Unlike the later Duplex Drive scheme, this vehicle was propelled in the water by a pair of small outboard motors, evident on the rear upper corner of the swim screen. (NARA)

ABOVE RIGHT
The M3E4 used inflatable pneumatic tubes to erect the frame for the canvas swim screen. Although pilots were built, the M3E4 program was abandoned as unseaworthy and too fragile. (NARA)

Although the British wading kit worked well enough, the heavy loss of associated tank landing craft pushed Britain away from wading kits and towards other means of amphibious armored assault, notably the Duplex Drive concept.

OPERATION *TORCH*

Operation *Torch*, the Allied landings on the French North African coast on November 8, 1942, saw the first extensive use of the Blue Freeze wading kits. A special Ordnance team under Major John O'Loughlin was dispatched to bases in the United States to install the Blue Freeze deep-wading kits on a portion of the tanks earmarked for Lieutenant General George Patton's Western Task Force. The kits were limited to M3 and M5 light tanks, since the Navy at the time lacked the capacity to load medium tanks into tank lighters at sea.

The *Torch* landings were conducted across a wide area of Morocco's Atlantic coast and Algeria's Mediterranean coast by three multi-division forces: the Western Task Force on the Atlantic Moroccan coast; the Center Task Force against Oran, Algeria; and the Eastern Task Force against Algiers. The plan was to deploy special Armored Landing Teams in the initial waves to support the infantry. These were typically a reinforced platoon of 5–6 light tanks fitted with the full Blue Freeze kits. The majority of tanks including all of the medium tanks were landed dry after the initial assault secured port facilities using a variety of improvised landing ships.

Force Blackstone of Western Task Force landed at Safi, Morocco and included 36 light tanks and 54 medium tanks of the 2/67th and 3/67th Armored, 2nd Armored Division, and B/70th Tank Battalion. The initial Armored Landing Team on five lighters arrived behind schedule in the pre-dawn darkness and all five M3 light tanks either became flooded or stalled in the soft sand. Two more teams totaling ten light tanks arrived after dawn and successfully moved off the beach to assist the infantry. The remainder of the tank force was landed on captured docks by the sea-train *Lakehurst* by mid-morning.

Force Goalpost had a large tank landing contingent including the 1/66th Armored, 2nd Armored Division, and C/70th Tank Battalion.

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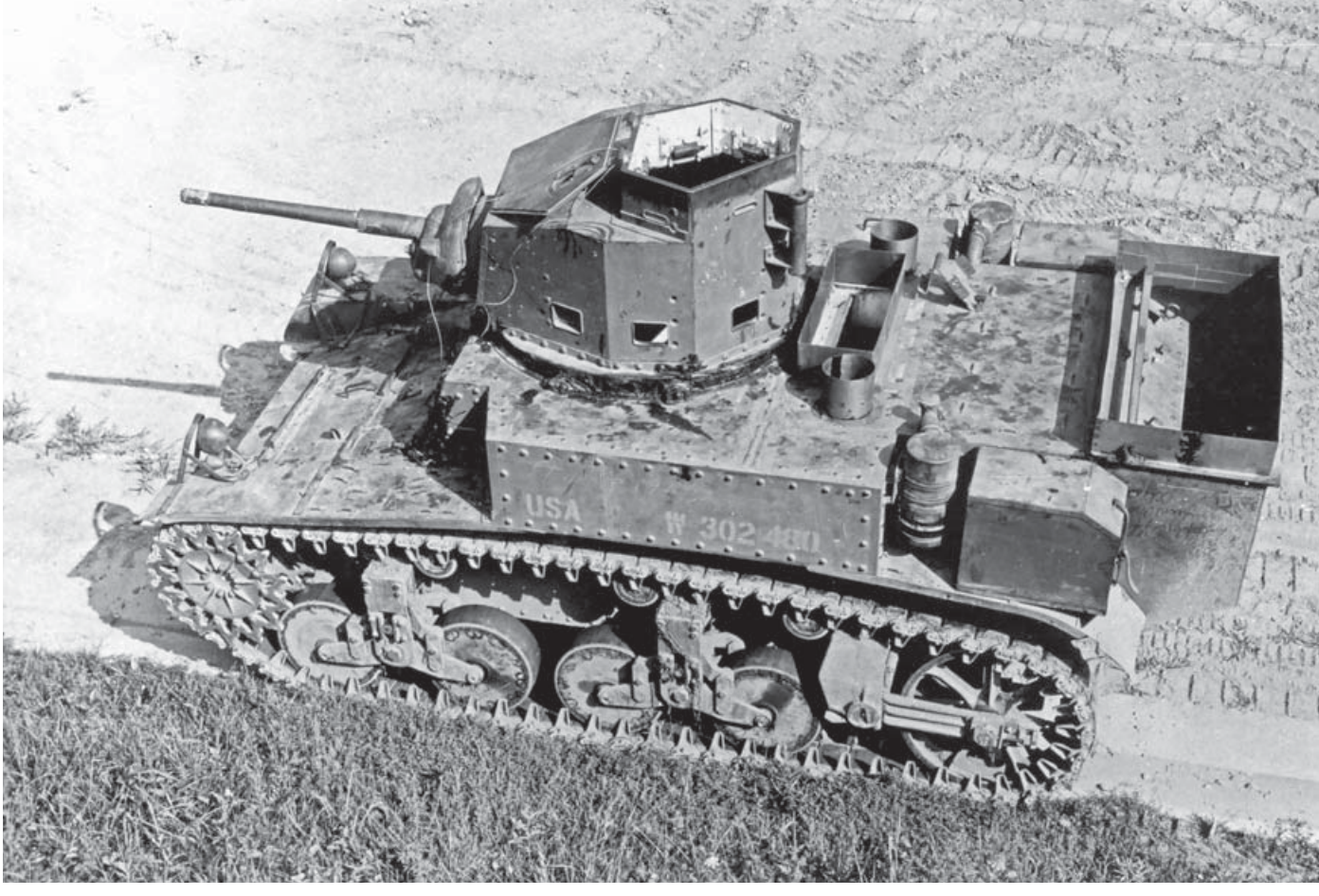

In the summer of 1942 the US Army began a secret program codenamed Blue Freeze to develop methods to land tanks from off-shore using a combination of waterproofing and wading trunks for the engine. This is one of the pilots at Aberdeen Proving Ground fitted to a hybrid test tank with an M3 hull and M2A4 turret. This pilot lacks the full Blue Freeze kit and is missing the vertical stacks. (NARA)

Twelve M5A1 light tanks of Company C, 70th Tank Battalion landed from tank lighters around 0130 hours at Port Lyautey. One tank was swamped in the high surf and the crew drowned. In another tank, the crew was overcome by exhaust fumes from the engine and inadvertently headed back into the surf after reaching the beach. One of the crewmen recovered in time to stop the tank and evacuate the crew. The Armored Landing Team of the 1/66th Armored had more trouble off the Mehdia beach when the high seas swamped one of the tank lighters but they managed to get seven M3 light tanks ashore. These proved invaluable when the French counter-attacked the beachhead with 32 old Renault FT tanks. They were quickly taken out by the M3 light tanks of 1/66th Armored, later reinforced by the M5A1 light tanks from the 70th Tank Battalion. This incident re-emphasized the urgent need to land tanks in the initial assault waves.

The landings on the Mediterranean coast of Algeria did not make extensive use of assault tactics from tank lighters. The only tank element of the force landing at Algiers was provided by M5 light tanks of Company A, 70th Tank Battalion, which landed against little opposition.

In general, the Blue Freeze deep-wading system proved to be an effective way to land tanks in the surf, though it was far from foolproof. As mentioned earlier, there were a number of cases where the waterproofing forced exhaust fumes into the crew compartment. In addition, the thin sheet-metal wading trunks were easily damaged, and the damage was often not noticed in the loading process. However, the design was sound enough that further efforts at deep-wading kits were simple evolutions of the original concept.

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The first Blue Freeze kits were manufactured for the M3 and M5 light tanks for immediate use during Operation *Torch* in French North Africa. However, a separate Blue Freeze kit was under development for the M4 and M4A1 medium tanks, and an example is seen here during trials on the Chesapeake Bay near Aberdeen Proving Ground in October 1942.

OPERATION *HUSKY*

By the time of Operation *Husky* in July 1943, the US Army was becoming more experienced in preparing tanks for armored assault landings. The most important innovations for *Husky* were not in novel approaches to tank design but in the growing sophistication of landing craft and ships. The first Landing Ship Tanks (LSTs) had become available, which could carry up to 48 medium tanks shore-to-shore. The LSTs were designed to carry an associated pontoon bridge system to permit tanks to be landed dry in the event that shore conditions were too shallow to permit the LST to land the tanks directly on the beach. The LSTs were too large a target and too vulnerable to be used in the initial assault landings, so the US Army was still interested in the use of deep-wading kits for tanks landed from LCM or LCTs.

In the wake of the Operation *Torch* landings, the modernization of the deep-wading kits was undertaken both by Ordnance back in the United States as well as by theater-based organizations. The primary agency for Operation *Husky* was the Fifth Army Invasion Training Center (5AITC) on the Algerian coast, which was responsible both for training tank units in beach assault tactics, as well as overseeing the attachment of deep-wading kits prior to the

A

1: M5 LIGHT TANK, 70TH TANK BATTALION, OPERATION *TORCH*, MOROCCO, NOVEMBER 1942

This M5 is fitted with one of the top-secret Blue Freeze deep-wading kits. Compared to later kits, the 1942 version had unusually large stacks. The waterproofing did not include extensive canvas covering for the gun mantlet and other openings, a situation that would be rectified in later kits.

2: M4A1 MEDIUM TANK, HQ CO., 68TH ARMORED REGIMENT, 2ND ARMORED DIVISION, OPERATION *HUSKY*, SICILY, JULY 1943

By the time of Operation *Husky* in 1943, the Blue Freeze kit had begun to evolve based on the lessons of Operation *Torch*. These kits were assembled and installed by the Fifth Army Invasion Training Center in Algeria. The stacks show the characteristic shape of the early Blue Freeze designs, with the mushroom-shaped cover on top of the stacks. The M4A1 was painted in the standard *Husky* scheme of earth yellow over the usual olive drab. The circled star was a new Allied recognition insignia based on experiences in Tunisia where there was concern that a plain white star could be mistaken for a cross at long range.

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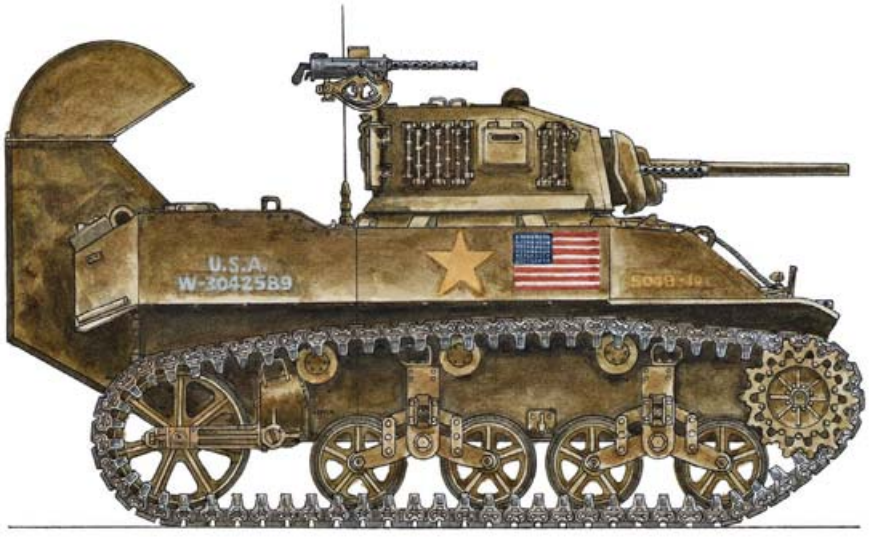

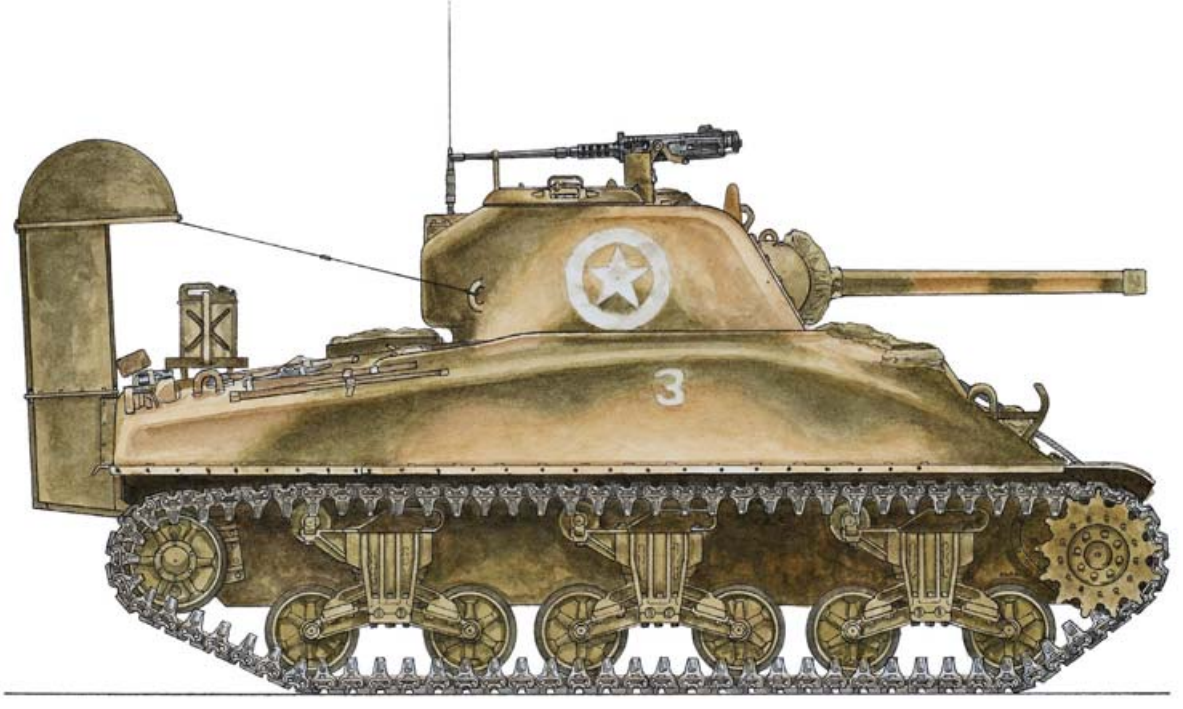

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assault. The deep-wading kits were fitted to the tanks of the 2nd Armored Division in the bivouac areas near Bizerte in late June 1943. While only a handful of light tanks had the Blue Freeze kits for Operation *Torch*, by the time of Operation *Husky*, the majority of light and medium tanks were fitted with the 5AITC kits.

The armored landing teams assigned to the support of the infantry at the three beaches in southern Italy were landed from LCTs; the follow-on waves were landed from LSTs using pontoon bridges when necessary. The landings were conducted against negligible resistance, and the 5AITC wading kits worked without any difficulty although most tanks landed dry or only had to wade through shallow water. The excellent results obtained with deep-wading kits made this approach the preferred tactic for the US Army.

One of the largely unrecognized consequences of the Blue Freeze program was the improvement in US Army vehicle reliability. It took over 250 hours to waterproof a Sherman tank and to attach the wading kit, with much of the time consumed in waterproofing internal electrical systems to prevent short-circuiting and water damage. To simplify this process, Ordnance in 1943 began a program to incorporate extensive waterproofing into all newly manufactured tactical vehicles including modified electrical harnesses and waterproofed electrical contact points. This proved to have very beneficial consequences during humid weather in the various combat theaters where previously there had been recurring problems with tank reliability due to water-induced damage to electrical systems.

The Operation *Avalanche* landings at Salerno in September 1943 and the Operation *Shingle* landings at Anzio in January 1944 were conducted using the 5AITC deep-wading kits. In both cases, the Germans followed their usual tactical doctrine and did not make a strong defense of the beach, but rather launched furious Panzer counterattacks after the beachheads had been established. The deep-wading tactic for amphibious landings had proven technically successful in all of the Mediterranean theater landings, but it had seldom been put to a strenuous test under fire.

In February 1943, following the use of the Deep Freeze wading kits during Operation *Torch*, the US Army provided details of the system to their British counterparts. The British Army had already developed their own wading kits such as those used at Dieppe. The US and British wading kits differed in many details, but both development establishments began an extensive program of cooperation on waterproofing and other amphibious landing technologies in anticipation of the planned landings in France in 1944. The British favored automated methods to remove the deep-wading kits from within the tank, so the stacks were designed to be shed via connecting wires, while the canvas shrouds over the gun mantlet were blown free using Cordtex (detonation cord). In contrast, the US deep-wading kits were far simpler and were designed to be manually removed by the crew at a waterproofing removal station on the landing beach; the tanks could still fight with the kits fitted. Regardless of the differences, the British Army sometimes used US-designed kits for some of their Lend-Lease tanks: for example, the kit for the M4/M4A1 (Sherman I/II).

The US Army decided against shipping deep-wading kits to Britain since they were bulky, fragile, and took up precious cargo space. Instead, Ordnance Service–ETOUSA (European Theater of Operations, US Army) was handed the responsibility of supervising their manufacture in Britain, based on Ordnance plans. Three experimental facilities were organized with British assistance,

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US Army tanks in the initial waves of the amphibious landings on Sicily during Operation *Husky* were fitted with the Blue Freeze kits, as seen with this example of a M4A1 of the headquarters company, 3rd Battalion, 67th Armored Regiment, 2nd Armored Division landing at Gela from a pontoon causeway connected to a Landing Ship Tank (LST). Deep-wading kits became the predominant method for landing US tanks during amphibious operations in the Mediterranean theater in 1943–44. (NARA)

and the Ordnance Service set up an associated waterproofing division to oversee the program along with several ordnance depots to carry out the work.

The configuration of the deep-wading kit underwent continual evolution due to the interaction of Aberdeen Proving Ground, Ordnance Service–ETOUSA, and their British counterparts. The original mushroom shape of the Blue Freeze stacks was simplified into a question-mark shape with a larger opening towards the front of the tank. The stacks in 1942–43 were attached vertically to the adapters, but in 1944 a new design was adopted with the stacks angled slightly to the rear. This was done so that the stacks would fall off by gravity with a minimum of effort once the attachment was removed by the crew.

A standard tank deep-wading kit in 1944 consisted of four main elements. The Tank Fording Kit T-O consisted of the common waterproofing materials such as sealing compound, grease, glue, and other equipment needed to attach the kit to the tank. The Stack Fording Kit MT-S (Medium Tank-Stack) was a universal stack for medium tanks. Due to the different configuration of various Sherman engines, there were separate adapter fording kits for each type; the MT-1 for the M4/M4A1 medium tanks, and the MT-3 for the M4A3. There were corresponding kits for various other armored fighting vehicles; for example, the LT-5 kit for the M5A1 light tank, the SPA-7 for the M7 105mm HMC, and the SPA-10 for the M10 3in. GMC tank destroyer. Following the standardization of deep-wading kits in late 1944, Ordnance assigned them the usual SNL (standard nomenclature list) industrial parts designators; for example, G104-5700778 for the M4A3 medium tank kit.

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There was some interest in replacing the stacks with a less bulky device. Most of the air intake through the wading stacks was needed for the engine cooling system, and so removal of this requirement would substantially reduce the size of the air intake stacks to a single small snorkel for engine combustion air. So in 1943 a project was initiated to develop a seawater-cooled external radiator. The experimental radiators were attached to an M4A2 tank, which entered tests in January 1944. Although the concept proved feasible, the stacks were much less complicated and expensive so the radiator idea fell out of favor.

OPERATION OVERLORD

The Duplex Drive Tank

The next major amphibious landing in the ETO was the Operation *Overlord* landing in Normandy in June 1944. This involved the use of the controversial Duplex Drive (DD) tank. The US Army, as mentioned earlier, had already rejected a swimming tank based on the Straussler apparatus. There was still considerable interest in swimming tanks, and by late 1943 there were several amphibious tanks under development in the US, which will be covered in more detail later. None was ready for production at the start of 1944. One of these, the Yagow Device, was a further elaboration on the Straussler Apparatus, but using mechanical means to raise the screens rather than pneumatic tubes.

The tactical details of the Normandy landings were formulated by COSSAC (Chief of Staff to the Supreme Allied Commander). The COSSAC

As an outcome of the earlier M3A4 project, Aberdeen Proving Ground was working on a variation of the Straussler Apparatus, called the DY Device or Yagow Device. It paralleled the DD tank program, but used mechanical means to erect the screens rather than inflatable pneumatic tubes. It reached the pilot stage in January 1944 but was not mature enough to be substituted for the DD tank. (NARA)

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staff was based in Britain and was far more strongly influenced by the disastrous use of tanks in the Dieppe raid in August 1942 than by the string of successful armored assault landings in the Mediterranean. The most salient lesson from the Dieppe landings in the eyes of the COSSAC planners was that the LCTs were too vulnerable to German coastal defenses. As a result, they sought another method to land tanks to support the landings. Although Britain had attempted a variety of schemes for amphibious landings, including deep-wading kits and various pontoon attachments, the COSSAC planners latched on to the Straussler apparatus.[2] By 1943, this had evolved into the Duplex Drive configuration, which propelled the tank in water using propellers connected to the tank's own engine rather than the set of outboard motors used in earlier configuration. Production of a DD tank based on the Valentine began at Metro-Cammell in April 1943 and by December 1944 a total of 595 had been converted. There was some concern that the Valentine was not adequate on the contemporary battlefield, so in 1943 a program was begun to equip the Sherman with the DD system. The British conversions were based on the M4A2 (Sherman III) and M4A4 (Sherman V) and manufacture for the Normandy landings began in early 1944.

On November 1, 1943 the COSSAC deputy commander, Brigadier General Ray Barker, first broached the issue of American use of the DD tank for *Overlord* with Major General Henry Sayler, the US Army–ETO Chief Ordnance Officer. At the time, the estimated Allied requirement was 639 DD tanks for British units and 199 for the US Army. The US figure was based on the expected use of the DD tank by three tank battalions, plus an additional number for training and attrition needs. After extensive briefings between British and American technical staffs in London, on November 7, the issue was broached with Lieutenant General Jacob Devers, who was the Commanding General, US Army–ETO prior to Eisenhower's arrival. Devers had commanded the Armored Force during its formative years and was knowledgeable about both tank equipment and the procurement process. Devers was unwilling to support the DD program since no one on his staff had ever been shown the DD tank nor had Lieutenant General Omar Bradley, commander of First US Army, which would be using the tank for *Overlord*. As a result, a series of demonstrations was arranged to acquaint the US Army about the DD tank, starting on November 17, 1943. In view of the short time available, Devers agreed to sponsor an emergency action to expedite the program and to initiate American production for US Army requirements. It was formally approved by the US Army chief of staff, General George C. Marshall on November 28. Due to the urgency of the program, it was given an AAA priority rating, very rare in tank production programs.

Even after winning emergency approval, the program faced substantial hurdles. Metro-Cammell had not completed the production drawings for the British DD tanks, to say nothing of duplicate drawings for the US Army. An initial batch of drawings was dispatched on November 25, but these were incomplete and related to the M4A4. The US Army decided to base their DD tanks on the M4 or M4A1 since this was the standard type in US service at the time. At first the scheme was to manufacture conversion kits in the United States and then have the conversions undertaken in US depots in Britain on tanks already in theater. The conversion was too elaborate for this method,

2 For further detail on the British DD program, see: Fletcher, David, *Swimming Shermans*, Osprey New Vanguard 123 (2006)

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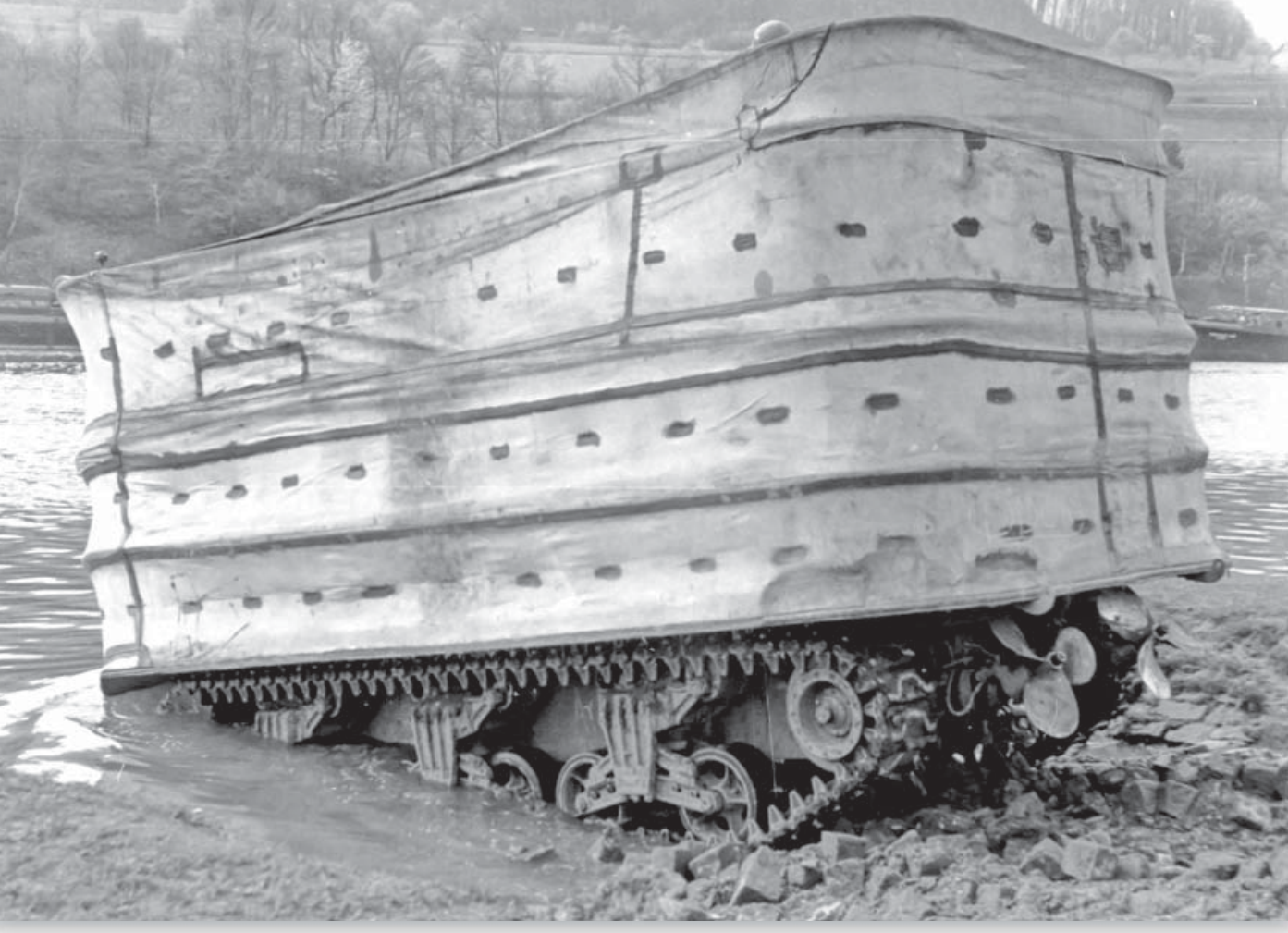

A DD tank with its screens fully erected. The two rear-mounted propellers are also evident in this view, as is the modified rear idler wheel. Although the idler was originally fitted with an outer sprocket like the forward drive sprocket, these were removed on the tanks in service. This particular photo was taken on April 30, 1945 during a training exercise by the 781st Tank Battalion on the Neckar River in Germany for potential use in crossing the Rhine in the Seventh US Army sector. (NARA)

and so the program switched the conversion effort to the United States. The main delay in the program was the slow pace of obtaining complete engineering drawings, which took nearly two months and was not completed until the end of January 1944. A set of parts for a single DD tank was shipped to the US and used to construct a pilot vehicle.

The DD program was handed over to the Cleveland Ordnance District, since the four main production facilities were located in Ohio. The lead plant was the Firestone Tire & Rubber Co. in Akron, supported by Federal Machine & Welder, Truscon Steel, and Warren City Tank & Boiler Co. The Lima Tank Plant was assigned for final testing and shipment. The first plan intended to convert new production M4A1(76mm) tanks into DD tanks, but since this new version had already been assigned to the ETO on an expedited basis, the plan switched to the use of the older 75mm M4A1. By the time the production program was underway in January 1944, the requirement had been raised to 350 tanks. The first pilot built with British components was delivered to Ft. Storey, Virginia for trials in late January 1944 but later sank during testing.

The first batch of 15 completed DD tanks left the Lima Tank Plant on February 24, 1944, less than a month after the final drawings had arrived from Britain. The initial batch was needed to start training US tank battalions in Britain and the first tanks arrived on March 10. This initial batch differed from later production vehicles in lacking an additional splash curtain on the rear, which had been added by US engineers to increase freeboard in the water. The production program was completed in mid-March, a remarkable

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The British Army requested the continued conversion of DD tanks in the United States after the original batch of 350 tanks was completed for the Normandy landings. The M4A2 was preferred, but by this time only the 76mm gun version was in production. This is the pilot for the 76mm version, but in the event, no series production ensued. (NARA)

accomplishment considering the short time span. As the US production program was coming to a close, in April 1944 it appeared that Metro-Cammell would be able to provide only 150 DD tanks by D-Day for British and Canadian units of the 366 requested. As a result, the obsolete Valentine DD tanks would have to be used. Instead, 80 American-built M4A1 DD tanks were transferred to Britain for the Normandy landings. The British began converting Sherman V DD tanks in March 1944, completing 331 by the beginning of June 1944, and 693 Sherman III and Sherman V by December 1944 when conversion ended. Since they were available sooner, more American-manufactured DD tanks were used on D-Day than British. There were 96 M4A1 DD tanks in use with the three US Army battalions and 76 M4A1 DD (Sherman II DD) with the British 8th Armoured Brigade on Gold Beach for a total of 172; the British and Canadian units on Juno and Gold beaches used 118 British Sherman V DD tanks.

The use of DD tanks for the *Overlord* landings was the subject of considerable controversy in the US Army. The commander of the US V Corps assigned to Omaha Beach, Major General Leonard Gerow, was opposed to the use of the DD tanks due to their technical immaturity and their fragility as demonstrated during the training exercises. He preferred the use of tanks with the proven deep-wading kits. At a December 1943 meeting, he reiterated his position with Bradley and his British counterparts. A compromise was reached under which the three US tank battalions assigned to *Overlord* would have two companies of DD tanks and one company of deep-wading tanks as

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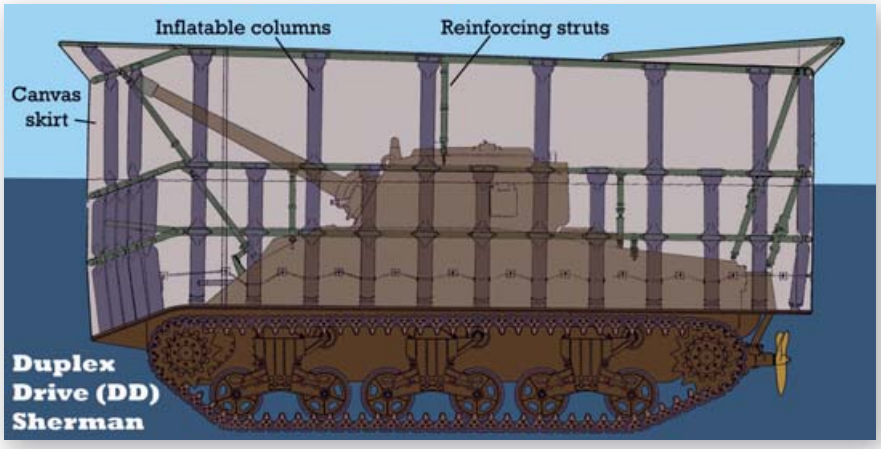

The DD tanks manufactured in the United States were all based on the M4A1 medium tank. This shows the standard configuration with the additional splash curtain on the front and rear of the swim screen. (Author's collection)

insurance. The remaining light tank company was withheld from the landings and the personnel used to flesh out specialist tank platoons. In place of the Porpoise ammunition sledge used by British tank units at Normandy, the US tank units used the M8 armored ammunition trailer.

Due to the secret nature of the DD tanks, the three D-Day tank battalions were isolated under the 3rd Armored Group for specialized training. These included the 741st and 743rd Tank Battalions for Omaha Beach and the 70th Tank Battalion for Utah Beach. A special tank school was established under the command of Major William Duncan of the 743rd Tank Battalion near Slapton Sands and the new training program began on March 15, 1944. The DD tanks were soon dubbed Donald Duck tanks by their US crews, and many crews derisively referred to them as "30 tons of steel in a canvas bucket." After preliminary technical training, the program was extended to sea launches in coordination with a special DD LCT Unit under the command of Lieutenant (jg) Dean Rockwell of the US Navy's Eleventh Amphibious Force. This program encompassed the training of both the US Army tank crews as well as the associated US Navy LCT crews who would be responsible for delivering the DD tanks on D-Day. Prior to D-Day, the school conducted over 500 launches from shore and over 1,200 launches at sea from LCTs. Three tanks were lost, one due to a failure of the rubber weld in the canvas skirt and two more due to damage to the skirt caused during a sea-launch; three crewman were lost in these incidents. There were at least six cases of carbon monoxide asphyxiation, which were especially prevalent during sea approaches that were conducted at ranges over 4,000 yards from shore. This led to the development of a sheet-metal trunk fitted to the rear of the engine deck to carry away the exhaust fumes more efficiently.

The training program and exercises revealed the capabilities and limitations of the DD tanks. On the negative side, the tanks were very fragile and it was very easy to damage their canvas screens while embarking or disembarking from the LCTs. They had acceptable performance in the water so long as the conditions were relatively calm, and technical problems were exacerbated if launched too far from shore. Rockwell's report to the Navy prior to D-Day warned that they should not be operated in sea states worse than Force 3, and that they should be launched at ranges of 4,000 yards or less. He also argued that a clear chain of command had to be instituted under which the senior Army officer would consult with the senior Navy officer. If sea conditions were too rough, Rockwell strongly urged that the LCTs land the DD tanks directly on the beach.

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As an alternative to the bulky deep-wading trunks, the US and Britain worked on a seawater-cooled external tank radiator, seen here fitted to an M4A2 tank in Britain in October 1944 with the left radiator in stowed position and the right radiator lowered for use. Although promising, the project faded from view after D-Day. (NARA)

Other Specialized Amphibious Tanks for D-Day

One of the most widespread myths about D-Day is that the US Army rejected the use of "Funny Tanks." The Funnies were a wide range of British specialized tanks deployed under the direction of the 79th Armoured Division. The assault plans for the British and Canadian beaches included a single DD tank regiment and an engineer tank regiment with counter-obstacle Funnies. After demonstrations of various types of specialized devices, the US Army prepared a list of the types sought for *Overlord*, which included 25 Crab flail tanks, 100 Sherman Crocodile flamethrowers, and a variety of specialized devices including 40 Bullshorn ploughs, 40 OAC Mk III ploughs, 50 Harrows, and 50 Centipedes. The US Army did reject the use of Funnies based on the Churchill tank, due to the logistical problem of introducing a new tank type only a few months before the landings, and selected British Funnies on the Sherman chassis. On February 1, 1944 Montgomery's 21st Army Group headquarters forwarded this requirements document to the British War Office. In the event, British industry was unable to produce sufficient Funnies for the British and none of the requested equipment was delivered to the US First Army in time for D-Day. Only a handful of Sherman Crocodiles and Crabs were delivered later in the summer to the US Army.

The principal British engineer tank was the Churchill AVRE (Armoured Vehicle Royal Engineers), which was a Churchill tank fitted with a Petard launcher, a type of direct-fire mortar launching a demolition bomb. Initial *Overlord* planning in January 1944 presumed that the US Army would also use the Churchill AVRE, but this was quickly abandoned due to a lack of sufficient units, and American dissatisfaction with the Petard. Although the weapon was useful in demolishing seawalls, it was not powerful enough to penetrate the steel-reinforced concrete walls of German bunkers, and the Petard had to be reloaded from outside the vehicle.

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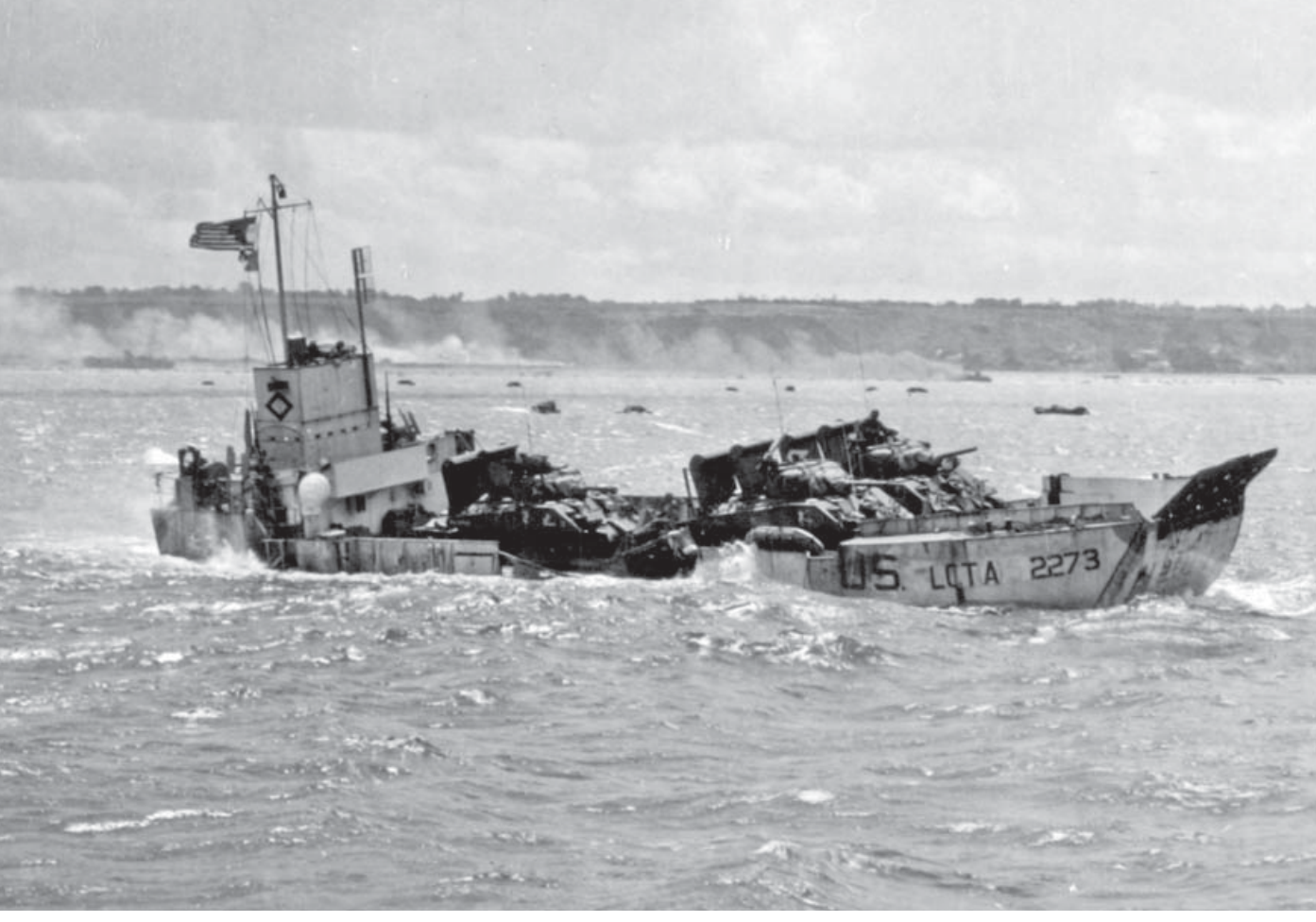

LCT(A)2273 is seen carrying tanks of Company A, 743rd Tank Battalion to the Vierville draw area of Omaha Beach on the morning of D-Day. This shows the standard load on D-Day, with two M4 tanks on elevated platforms in front, and an M4 dozer tank behind them. This craft was damaged by German shore fire and split in half; it sank later in the day after delivering the tanks. (NARA)

In place of the Churchill AVRE and other engineer Funnies, the US Army had been developing the EAV (Engineer Armored Vehicle) based on the M4 medium tank that was fitted with the T40 7.2 inch "Whiz-Bang" demolition rocket launcher and an M1 dozer blade. In the event, it was not ready for production in time for D-Day, so First US Army planned to fit the Shermans in the three deep-wading tank companies with the demolition rocket launcher. A number of sets were shipped to Britain and were first fitted to the tanks of the 70th Tank Battalion, earmarked for the Utah Beach landings. The tank crews were dismayed by the proximity of the launch box to the turret hatches, which made turret-crew escape impossible. After experimental firings against simulated obstacles and bunkers, the battalion argued that the launcher was no more effective than a few rounds from the 75mm gun, and so the use of the Whiz-Bang was abandoned.

The US Army was not amused by most of the other British engineer gimmicks mounted on the Churchill and preferred the more versatile LaPlant-Choate M1 tank-dozer. These were fitted to the M4 and M4A1 medium tanks along with a deep-wading kit for use on D-Day, and the first conversion kits arrived in May 1944. A total of 16 dozer tanks were allotted to the two tank battalions assigned to Omaha Beach, and four to Utah Beach. On Omaha Beach, the dozers were deployed in special dozer platoons formed from the battalion's usual assault gun platoon; each had eight dozers, including two from accompanying engineer units. More extensive use of specialized engineer and demolition tanks on the US beaches was prohibited by the lack of LCTs.

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The D-Day Assault

The US Army DD tanks were the vanguard of the D-Day assault. As a result of the Dieppe raid, the tanks were expected to land ten minutes before the arrival of the first infantry troops in order to begin suppressing German strongpoints at the earliest opportunity. The DD tanks were launched from LCT(6), each delivering four DD tanks, with their arrival at the beach scheduled for H-10. They would be followed by the deep-wading tanks and dozers delivered on modified LCT(A). As a result of the Dieppe experience, the LCT(5) had 2 inches of armor added over vital parts to reduce their vulnerability to small arms and machine-gun fire, and redesignated as LCT(A). Each LCT(A) carried three tanks: two wading tanks forward and a dozer tank behind. The wading tanks rode on an elevated platform made from wooden beams that allowed them to fire against German bunkers on the approach to the beach. The LCT(A) were instructed to deposit the wading tanks in shallow water, not directly on dry land because the prescribed tactic was for the tanks to remain in the water up to their turret rings to make them less vulnerable to German gun batteries. The same applied to the DD tanks, and the crews were instructed to leave the rear portion of the screen erect to provide some shelter from the waves. The tanks could fire against German bunkers from the protection of the water, and gradually advance closer to the beach as the tide rose through the morning. In the event, this tactical advice was widely ignored.

Each battalion had 32 DD tanks and 16 deep-wading tanks, plus the dozer tanks as mentioned earlier. Some DD crews felt that their tanks did not have enough ammunition and loaded an extra 60 to 100 rounds of 75mm gun ammunition and other supplies, adding more than a ton of weight beyond the standard combat load. This would exacerbate the existing shortcomings of the DD Tank on D-Day. During the approach to Normandy on the night of June 5–6, two LCT(A) were lost in the dark, one hitting a mine and the other being swamped by the rough weather. Poor weather on June 6 conspired against the DD tanks with choppy Force 4 sea conditions: winds up to 18 knots and waves of 4 to 6 feet – well beyond the Force 3 limit set by the Navy for launching DD tanks at sea.

The two company commanders of the DD tanks in Assault Group O-1 of the 741st Tank Battalion on the east side of Omaha Beach decided to launch the DD tanks. The unit after-action report recorded that "both commanders agreed that the advantage to be gained by launching the tanks justified the risk of launching the tanks in the heavy sea." The tanks began to leave the LCTs around 0535, about an hour before H Hour, at a distance of approximately 5,000 yards from shore. Not only were the sea conditions too rough, but the launch range was not prudent even in calmer conditions. The results were grim. All 16 tanks of Captain Charles Young's Company C sank after launch off Fox Green Beach, some near the LCTs when their canvas screens collapsed after launch. In other cases, the tanks were able to propel themselves for a thousand yards or more before the water pressure finally caused seams to rip open or the reinforcing struts to buckle and the screen collapse. The majority of the tank crews from the sunken DD tanks were picked up by accompanying coastguard craft.

Captain James Thornton's Company B, 741st Tank Battalion fared a little better, in part due to the late arrival of two of its LCTs, which launched closer to Omaha Beach. The two DD tanks of Sergeant George Geddes and Sergeant Turner Sheppard crawled ashore on Easy Red, the first US troops to land on

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An M4 dozer tank and M4A1 with M8 ammo trailer named Aide de Camp of Co. A, 741st Tank Battalion on board their LCT(A) prior to departure for Omaha Beach in June 1944. Both tanks are fitted with the standard deep-wading package of the T-O Tank Fording Kit, MT-S Stack Fording Kit, and MT-1 Adapter Fording Kit. (NARA)

Omaha Beach. When LCT-600 tried launching its DD tanks, the first sank about 100 yards from the craft, and the remainder had their canvas skirts damaged when a German artillery round landed nearby, causing the craft to lurch and the tanks to crunch into each other. The LCT commander decided it was too risky to launch the damaged tanks, and so he delivered them to shore, landing at 0632 on Easy Red. As a result, only five DD tanks of the Assault Group O-1 landed on Omaha Beach. The deep-wading tanks of Company A followed in six of the original eight LCT(A) assigned to Assault Group O-1; one had been lost at sea the night before and one was delayed by the weather. The six LCT(A) reached the beach around 0630 hours and

B

CO. B, 743RD TANK BATTALION, DOG WHITE SECTOR, OMAHA BEACH, D-DAY, JUNE 6, 1944

The first LCT from Assault Group O-2 to land on the western side of Omaha Beach was LCT-535 commanded by Lt. (jg) Dean Rockwell and carrying DD tanks of Co. B, 743rd Tank Battalion. Rockwell had led the pre-invasion training course for the DD tanks and LCT crews and was well aware of the hazards of operating the DD in rough seas. As a result, he convinced the Army company commander to land the tanks directly on shore rather than risk a dangerous swim to shore under their own power. As a result, the 743rd Tank Battalion landed largely intact on D-Day, in contrast to the neighboring 741st Tank Battalion, which lost most of its DD tanks at sea. The DD tank markings were very austere. The registration number was painted on the front turret side instead of the usual location on the hull rear due to the canvas skirts. Units assigned to the landing were issued special unit identification markings called ETOUSA–POM markings (European Theater of Operations US Army–Preparation for Overseas Movement) which consisted of a five-digit number and three color bars that corresponded to the last and penultimate numbers of the number. The insignia shown here from left to right are Cos. A, B, and C of the 743rd Tank Battalion. This marking was about 9 inches in width, and was usually painted on the lower front and rear of the tank for identification during the embarkation process in England. The flag insignia shown here was a paper insignia issued to all vehicles with spaces for written embarkation information. It was usually pasted in front of the driver's hatch on Sherman tanks, or on the windshield of unarmored tactical vehicles.

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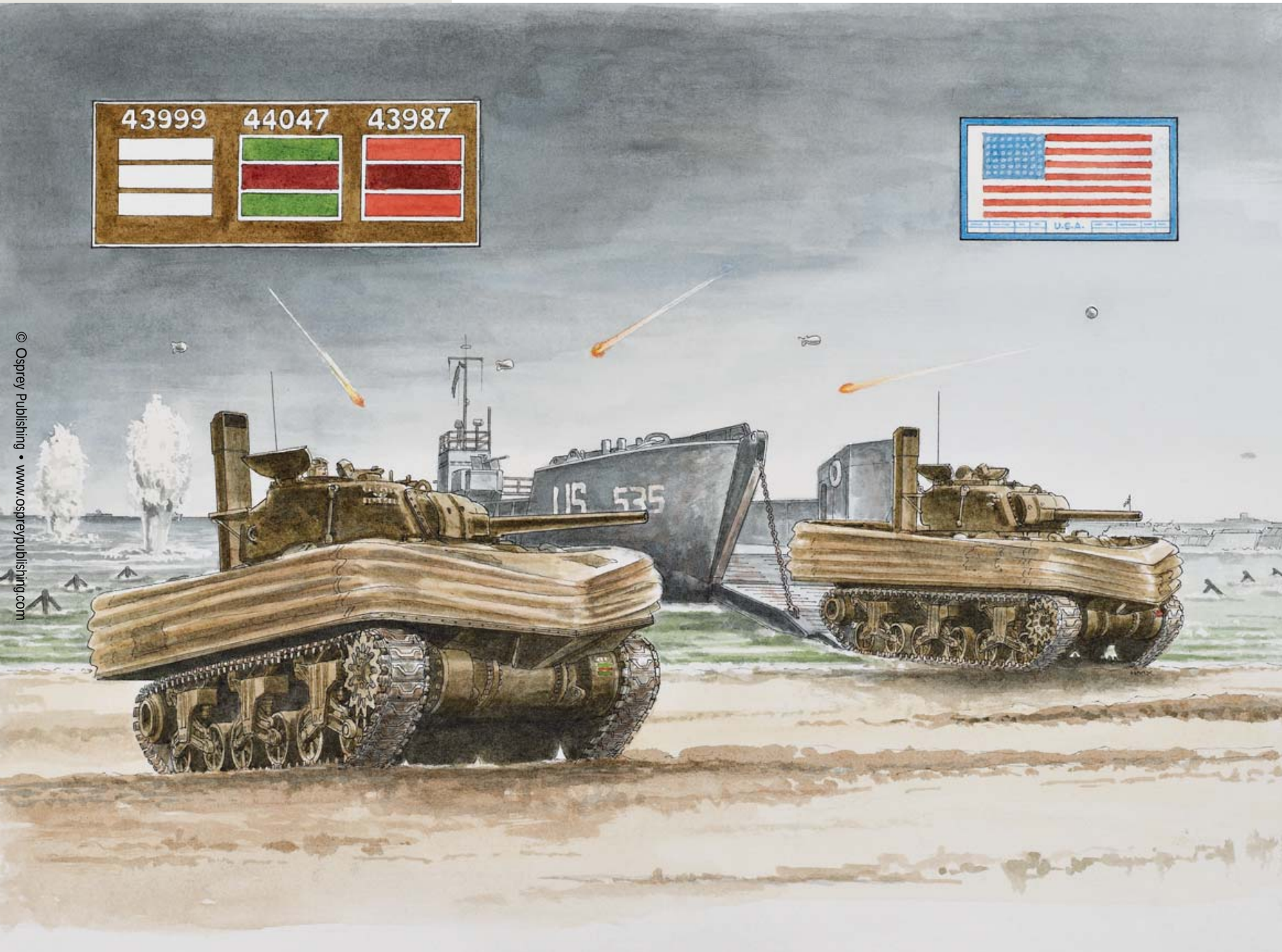

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An M4A1 tank named Adeline II from Co. A, 741st Tank Battalion is seen here being recovered a day after the invasion by one of the battalion's T2 tank recovery vehicles in the village of Colleville beyond the beach. This tank was hit on its left rear bogie by a German 50mm anti-tank gun during the Omaha Beach fighting. The crew continued to fight from this tank for most of the day but could not crawl over the seawall due to the damage. (NARA)

delivered six wading tanks and five dozer tanks. As a result of the heavy losses among the DD tanks, Assault Group O-1 managed to deliver only 16 of its original 56 Sherman tanks.

Assault Group O-2 on the west side of Omaha Beach was blessed by more prudent decisions. Lieutenant Dean Rockwell, the Navy commander, convinced his Army counterpart, Captain Ned Elder, that the seas were too rough to launch the DD tanks and instead ordered the LCTs to deliver them to shore. Rockwell's LCT-535 touched down at 0629, the first craft in the first wave to reach the western side of Omaha Beach. Assault Group O-2 managed to deliver 32 DD tanks, seven wading tanks, and three dozers around H-Hour – 42 of its original 56 Shermans. Others were delayed and landed later in the morning.

The arrival of the two armored assault groups was met by intense German fire. Along the 7-mile beach the Germans had numerous bunkers with anti-tank guns and field guns, the most deadly of which were a pair of 88mm anti-tank guns enfilading the beach from either side. The tanks quickly returned fire. Sergeant Geddes' DD tank knocked out the dangerous 88mm bunker at the eastern side of the beach with a direct hit through its vulnerable embrasure. Sergeant Sheppard's DD tank silenced a pair of 75mm field gun bunkers on the top of Engineer Hill with a volley of well-aimed shots. Sheppard's action would have important consequences as these bunkers covered the sector where a platoon from the 16th Infantry was the first to get off "Bloody Omaha."

The slogging match between the tanks and the bunkers continued through most of the morning with mixed results. The complex of bunkers in strongpoints WN72 and WN71 on the western side of the beach proved to

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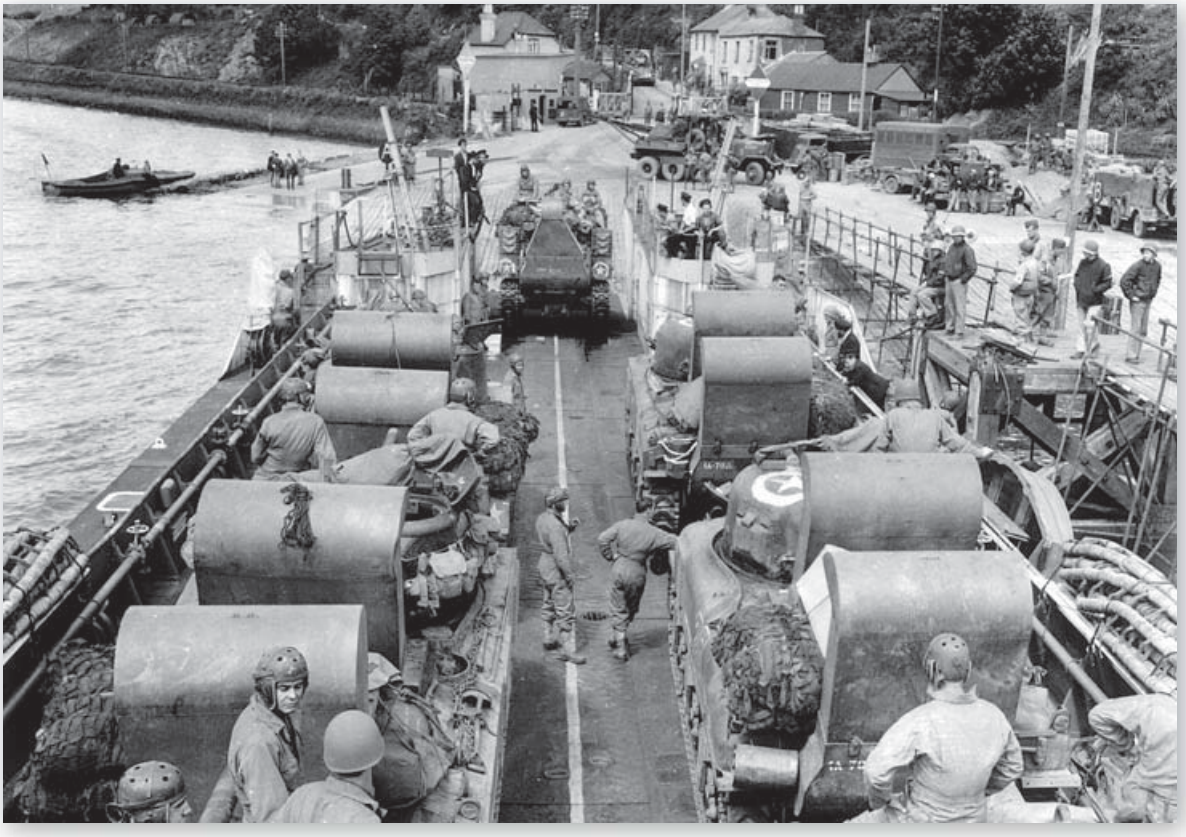

Seen here are several M4 and M4A1 medium tanks of Company C, 70th Tank Battalion with deep-wading trunks before setting off from Kingswear, England, for Utah Beach. (NARA)

be particularly lethal and they were not silenced until late in the morning when US Navy destroyers approached within a thousand yards of shore and blasted them repeatedly with 5-inch gunfire. The principal tactical problem confronting the tanks on Omaha Beach was the restricted mobility caused by the high bluffs that prevented exit except through the four heavily defended draws (ravines) at Vierville, Les Moulins, St. Laurent, and Colleville. Once the tide rose by mid-morning, the tanks' movements became even more restricted and one tanker later recalled his tank spent most of the day "going thirty feet forward, or thirty feet back, that was all."

At the end of D-Day the 741st Tank Battalion had only three tanks in action, two others under repair, and 48 lost or disabled during the day's fighting. These appalling losses forced V Corps to begin landing its reserve, the 745th Tank Battalion, in the early evening of D-Day. The 743rd Tank Battalion was still able to fight, exiting through the Vierville draw at 2230 hours with 31 DD and eight wading tanks. In spite of the challenges, the tanks had proven invaluable in reducing the German fortifications on Omaha Beach. The most fitting tribute to the tankers was the remarks of the commander of the 2nd Battalion, 116th Infantry, who said that they had "saved the day. They shot the hell out of the Germans and got the hell shot out of them."

Utah Beach

In contrast to Omaha Beach, the landings on Utah Beach were conducted with far less trauma. The eight LCTs carried 32 DD tanks of the 70th Tank Battalion; four DD tanks were lost when their LCT struck a mine, and one

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Tank casualties on Utah beach were due almost entirely to mines. This M4 medium tank named *Cannonball* of Co. C, 70th Tank Battalion became trapped in a hidden shell crater while driving to the beach from its LCT. The two deep-wading trunks are very evident in this view. This was one of the tanks fitted to carry the T40 Whiz-Bang rocket launcher, evident from the mountings welded to the turret. (NARA)

more was swamped by a landing craft. Due to weather delays, the remaining 27 DD tanks landed behind schedule ten minutes after the first wave of infantry. The German coastal defenses were far less extensive and had been largely silenced by air attack and naval bombardment. Twelve wading tanks and two dozer tanks landed with the third wave at H+15 (0645). By 0900 the beach defenses had been reduced and the 8th Regimental Combat Team was moving inland, led by DD tanks from the 70th Tank Battalion. The 8th Infantry Regiment was the only US unit to reach its D-Day objectives, in no small measure due to the excellent support provided by the 70th Tank Battalion. During the course of D-Day, the 70th Tank Battalion lost 16 medium tanks, nine at sea.

The US use of amphibious tanks on D-Day is encrusted in myth, one of the more persistent being that most US tanks sank during the approaches. In reality, about three-quarters reached the beach. However, in retrospect, the decision to employ the DD tanks in US battalions for Operation *Overlord* was a minor mistake. The design was too flimsy in strong seas, and as a result only about 120 of the 290 DD tanks deployed on D-Day in all Allied units were

C

M4A1, CO. A, 741ST TANK BATTALION, FOX GREEN SECTOR, OMAHA BEACH, D-DAY, JUNE 6, 1944

Although most of the DD tanks of the 741st Tank Battalion were lost at sea, the majority of the deep-wading tanks reached the shore safely. The deep-wading tanks towed an M8 armored ammunition trailer behind them, as seen here. These tanks were fitted with the latest style of deep-wading kits with the new 1944 "question mark" stacks angled backwards to make it easier to detach them once ashore. The tank was fitted with numerous sections of Admiralty canvas covers over openings, and any cracks or other potential points for water intrusion were slathered with Bostik sealant to prevent leakage. The ETOUSA–POM markings shown here are, left to right, for the battalion's Cos. A, B, and C.

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This M4A1 DD tank from Co. A, 70th Tank Battalion was hit by a hidden German anti-tank gun while moving over the Exit 2 causeway off Utah Beach. The damaged tank was pushed off the causeway to clear it for following troops. As can be seen, the canvas flotation screens on this DD tank had been folded down. (MHI)

actually launched at sea. Of these, at least 42 sank. More DD tanks were landed directly on shore or in shallow water than launched at sea – about 140 of 290 DD tanks. The American experience with DD tanks was not that much different from that on the British and Canadian beaches. US DD tank units suffered 38 percent losses to sinking (22 of 57 tanks launched at sea) versus 31 percent (20 of 64) on the British and Canadian beaches. What was different was the heavy concentration of losses within a single US tank battalion. Had the US tank battalions used the more dependable deep-wading tanks, the US Army might have had more tank support in the Colleville sector of Omaha Beach. However, it is by no means clear that this would have had any dramatic impact on the fighting there. It should be borne in mind that it was in the Colleville sector that the experienced 16th Infantry with little tank support made the earliest penetrations of German defenses; in the Vierville sector, the green and inexperienced 116th Infantry with more tank support had greater difficulty overcoming German defenses.

OPERATION *DRAGOON*

The US Army planned to stage an amphibious landing on the Mediterranean coast of France at the same time as Operation Overlord. The Operation Anvil plan, like Overlord, envisioned the use of DD tanks to support these attacks. Of the 348 DD tanks shipped to Britain, 210 were sent to the 3rd Armored Group for Normandy, 80 were turned over to Britain for Normandy, and much of the remainder were dispatched to the Seventh US Army in Italy for the planned southern France landings. In the event, Operation Anvil was postponed until August 15, 1944 and in the meantime was renamed

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Operation Dragoon. A total of 36 DD tanks were deployed in the landings with three tank battalions.

At Alpha Red Beach in Cavalaire Bay, south of St. Tropez, four DD tanks of the 756th Tank Battalion preceded the main landing force. One was sunk by a mine, while the three surviving tanks parked in shallow water and proceeded to engage targets of opportunity. The landing on Alpha Yellow proceeded in much the same fashion, with DD tanks leading the way. However, the infantry landing craft proceeded to the beach so quickly that they passed the swimming tanks, and one tank was sunk by the wake of an accompanying PT boat. Another tank was disabled on the beach by a mine, but there was so little resistance on the beach that the tanks saw little combat. The attack on Delta Red and Delta Green beaches on the opposite side of the Golfe de St. Tropez, east of Ste. Maxime, was preceded by four DD tanks. They safely swam ashore, but all hit mines and were disabled. The landing to the right on Delta Yellow and Delta Blue beaches was preceded by eight DD tanks of the 191st Tank Battalion, which had fewer problems with mines. At Camel Green and Camel Blue near St. Raphael, the eight DD amphibious tanks of the 753rd Tank Battalion were launched from 4,000 yards off shore and so arrived after the first wave of infantry landing craft. Of the 36 DD tanks used in Operation *Dragoon*, 20 were launched from their LCT at ranges of 75 to 4,000 yards, and the remaining 16 were landed directly on the beach. The use of DD tanks in southern France was much more successful than in Normandy because of the calm sea conditions and the light German opposition on most of the beaches.

Curiously enough, the DD tank program remained active in the United States after the Normandy landings, though based on British rather than American requirements. The British Army requested the delivery of additional DD tanks via the Lend-Lease program, based on either the

An M4A1 DD "Donald Duck" tank of the 753rd Tank Battalion that landed with Camel Force in support of the 36th Division near St. Raphael during Operation *Anvil*, the landings in southern France, on August 1, 1944. (NARA)

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The lack of deep-wading kits proved a major handicap to Company C, IMAC Tank Battalion when it landed on Tarawa on November 20, 1943. This is "Cobra," an M4A2 of the 1st Platoon commanded by Lt. Richard Sloat. Although it landed safely during the third wave, it drowned out in a deep shell crater on November 21 while moving to engage a Japanese field gun. (NARA)

M4A2 or M4A4 tank. Since M4A4 production had ceased, this meant that the M4A2 (Sherman III) would be used. By the time that the request had been received, production had shifted to the M4A2(76mm), which complicated manufacture due to the longer gun tube. In the event, pilots were built but no production followed.

PACIFIC THEATER OF OPERATIONS

The requirements for amphibious tanks in the Pacific Theater of Operations (PTO) were somewhat different from those in Europe. The US Navy gave higher priority to the Pacific for assault craft and landing ships. Innovations in landing ships such as the LSM (Landing Ship Medium) and LSD (Landing Ship Dock) greatly facilitated the use of tanks in amphibious assaults.

Through 1943, Marine tank units in the Pacific theater were isolated from developments in the United States, and this became painfully clear during the first contested amphibious landing at Tarawa in the Gilbert Islands on November 20, 1943. This was the combat debut of the I Marine Amphibious Corps (IMAC) Tank Battalion equipped with M4A2 medium tanks. The plan was to land the tanks as close to shore as possible from LCM (Landing Craft Mechanized); as a result, the need for deep-wading kits was not fully appreciated. Due to lack of supplies, waterproofing was limited to the use of grease in the lower recesses of the tank hulls. The undetected presence of a coral reef prevented the landing craft from reaching the shoreline. The six M4A2 tanks of 1st Platoon, Company C assigned to Beach Red-1 were dropped in waist-high water 1,200 yards offshore. As they approached the beach, the tank drivers saw a thick carpet of wounded and dead Marines in front of them. To avoid running them

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During some of the later campaigns the new LSM was used to deliver tanks ashore, as is the case here with LSM-141 delivering deep-wading M4A3 tanks of the Marine 4th Tank Battalion at Iwo Jima in February 1945. (NARA)

over, the tanks tried to move to the flanks of the landing area; three had their engines fail in the deep water and another ran into one of the huge shell holes created by the pre-invasion bombardment. Only two tanks made it to shore. Eight more M4A2 medium tanks from 2nd and 3rd Platoons were dropped off at Beach Red-3 but, under intense fire from entrenched Japanese guns, only three made it to shore. By the end of D+1, there were only four medium tanks operational of the 12 deployed to Tarawa. No M3A1 light tanks got ashore on D-Day, after the four LCMs carrying tanks of 2nd Platoon, Company C, 2nd Marine Tank Battalion were sunk off the beach. The first M3A1 light tanks arrived on D+1 and two other platoons landed all 12 of their M3A1s successfully on D+2, the final day of major fighting. The landings of the light tanks proved less troublesome since they were not landed under enemy fire and, by the time they arrived, channels had been found to permit them to land directly on the beach to prevent water damage.

By the time of the Kwajalein landings in the Marshalls in February 1944, standard deep-wading kits were being issued to Army and Marine tank battalions in the Pacific. These M4A1 medium tanks of the Army's 767th Tank Battalion are seen landing on Enubuj in support of the 7th Infantry Division. They are fitted with the standard late 1943 deep-wading kit, characterized by the vertical "question mark" stacks.

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The growing sophistication of Navy landing ships reduced the need for dedicated amphibious tanks in favor of the simpler deep-wading kits. The LSD (Landing Ship Dock) was a particularly efficient design since its rear well-deck could carry up to 14 LCMs with their tanks onboard. This LSD is carrying troops of the 163rd Regimental Combat Team of the Persecution Task Force for an assault near Aitape, New Guinea on April 22, 1944. The LCM in the center and the LCT behind contain M4A1 medium tanks of the 603rd Tank Company. (NARA)

Tarawa provided the Marine Corps with a clear lesson about the vital importance of deep-wading kits. Some Marine units received standard Army deep-wading kits while others made their own with the help of local Navy workshops based on the Army's instructions. The first use of deep-wading kits took place in November 1943 with the US Army on Makin.

Much of the manufacture of deep-wading kits in 1943 and early 1944 was undertaken overseas such as in the 5AITC in Algeria for the Mediterranean theater and US Army ordnance depots in Britain for the ETO. In October 1943, US Army Ordnance began a formal program to manufacture a standardized kit for the M4 series of medium tanks as well as similar kits for the M5A1 light tank and other armored vehicles instead of the improvised theater kits. The standard kit for the Sherman tank was designated as G9-5700772 for the waterproofing kit and G9-5700775 for the standard fording stacks. There were four special adapter kits for the M4/M4A1, M4A2, M4A3, and M4A4, since each had a different engine configuration and different air intakes and exhausts. By the time of the 1944 landings, a standardized kit was becoming available from the US that became a common feature of amphibious operations in the Pacific Theater of Operations in late 1944 and early 1945 with both US Army and Marine Corps tank units.

Amphibious tank assault tactics in the Pacific were significantly different from the Normandy landings. The US Navy had sponsored the development of an armed version of the LVT-2 amtrac, which entered production in August

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The majority of tank assault landing operations in the Pacific used the LCM landing craft to deliver the tanks to shore. Here, a pair of LCM from the LSD-6 are seen bringing a pair of US Army M4A3 tanks ashore during the Operation *Iceberg* landings on Okinawa on April 1, 1945.

1943 as the LVT(A)-1. Although called an amphibious tank, it was in fact very poorly armored. It was fitted with a turret derived from that of the M5A1 light tank minus the radio bustle, but it had only modest armor protection of a quarter-inch (6mm) on the hull sides and only a half-inch (13mm) on the driver's front plate and turret. As a result, it was protected only against small-arms fire. The amphibious tanks, often called amtanks or amphtanks, were intended to provide fire support during the initial phase of the landings, and the Marine and Army amphibious tank battalions usually comprised the first wave in major landing operations. While afloat, their bulky and weakly protected hulls were shielded by the water but they became extremely vulnerable after leaving the water. The LVT(A)-1 was first used in small numbers during the Kwajalein landings in February 1944. The 37mm gun of the LVT(A)-1 was nearly useless against typical Japanese defensive positions, but in the meantime the LVT(A)-4 had been developed, which substituted the open-topped turret from the M8 75mm Howitzer Motor Carriage.

The first real test of the amtanks came during the Saipan landings in June 1944, when two amphibious tank battalions with 138 LVT(A)-1 and LVT(A)-4 were employed. The Saipan landings provided a clear lesson in the limited viability of the amtank once it left the water. Of the 68 LVT(A)-1 and LVT(A)-4 supporting the 2nd Marine Division landings, three were disabled before reaching the beach and 28 were disabled near the shore before reaching the "Tractor Control Line" about 300 yards inshore, where the regular amtracs disgorged their troops. In spite of their limitations,

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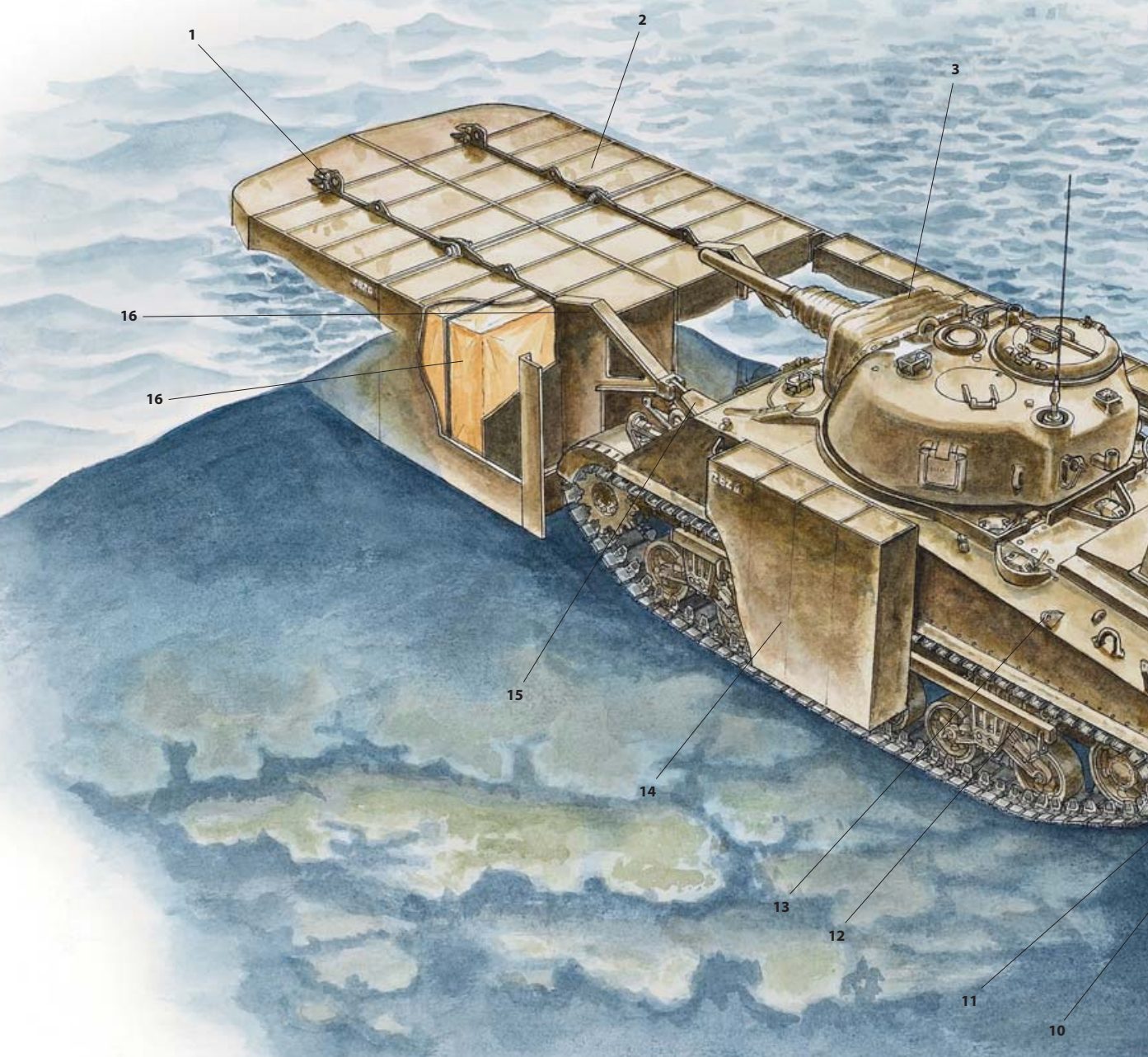
Key

1. Front pontoon lift hook
2. Front flotation pontoon
3. Improved Surfizer kit (gun mantlet cover)
4. Right side flotation pontoon
5. Engine deck deep-wading stack
6. Steering rope
7. Rudder actuation rod
8. Rudder (folded upward for landing)
9. Rear flotation pontoon
10. Rear pontoon hull attachment
11. Rear deep-wading stack
12. Side flotation pontoon attachment bracket
13. Side flotation pontoon attachment brace
14. Left side flotation pontoon
15. Front hull pontoon attachment fitting
16. Cellophane-wrapped plastic foam flotation cells
17. Forward pontoon mounting bracket



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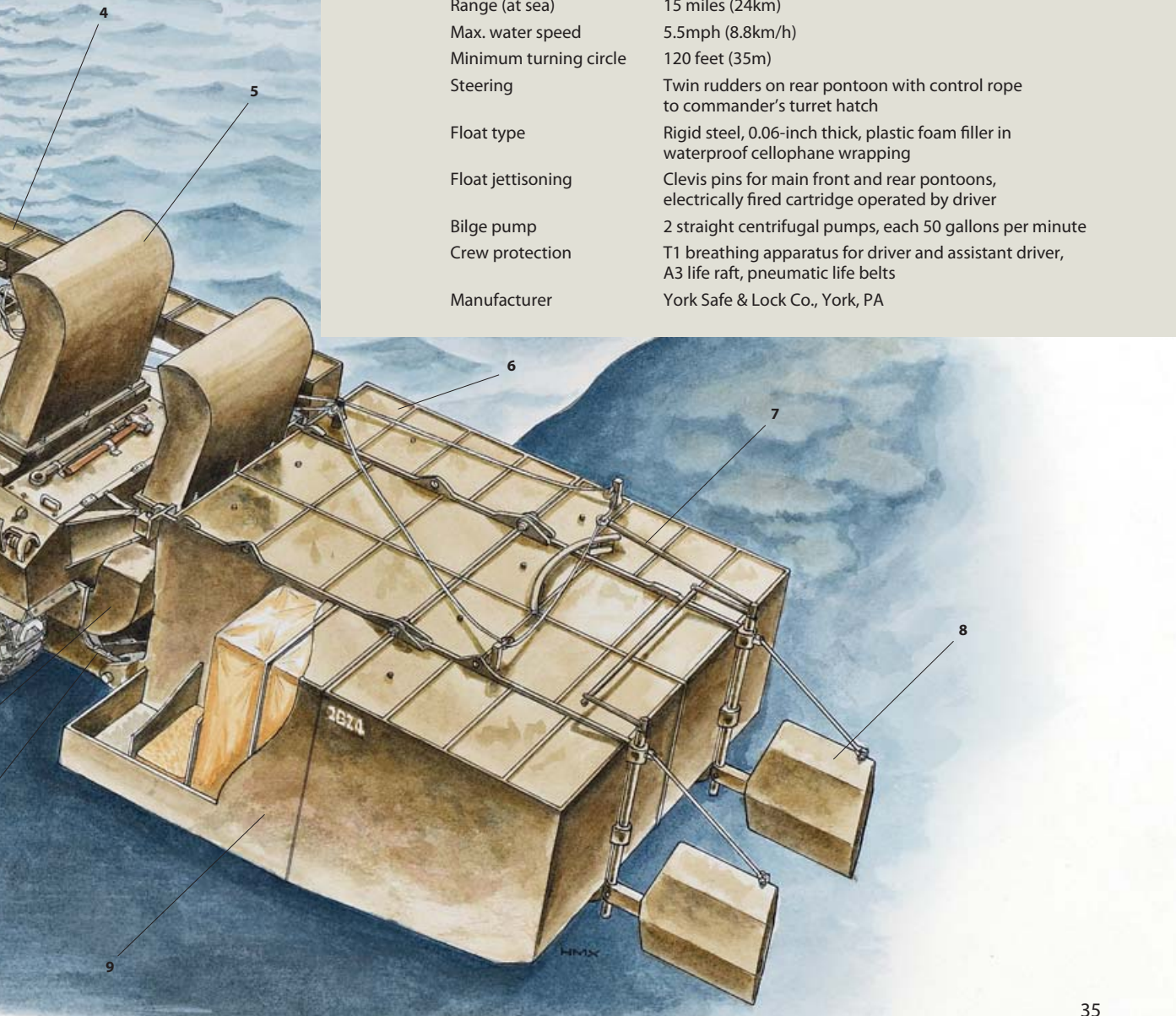
D T6 DEVICE, US ARMY 711TH TANK BATTALION, OPERATION ICEBERG, OKINAWA, APRIL 1945

TECHNICAL DATA

Tank	M4A3 medium tank
Combat weight	42 tons (38,100kg)
T6 Device weight	8.6 tons (7,800kg)
Length	47.6 feet (14.5m)
Width	11 feet (3.3m)
Height	12.7 feet (3.9m)
Turret traverse	310 degrees (until stacks removed)
Turret covering	Improved Surfizer kit
Freeboard	14 inches (355mm)
Draft	60 inches (1.525m)
Propulsion	Tank tracks (rubber or steel chevron with extended end connectors)
Range (at sea)	15 miles (24km)
Max. water speed	5.5mph (8.8km/h)
Minimum turning circle	120 feet (35m)
Steering	Twin rudders on rear pontoon with control rope to commander's turret hatch
Float type	Rigid steel, 0.06-inch thick, plastic foam filler in waterproof cellophane wrapping
Float jettisoning	Clevis pins for main front and rear pontoons, electrically fired cartridge operated by driver
Bilge pump	2 straight centrifugal pumps, each 50 gallons per minute
Crew protection	T1 breathing apparatus for driver and assistant driver, A3 life raft, pneumatic life belts
Manufacturer	York Safe & Lock Co., York, PA



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The LVT(A)-1 and LVT(A)-4 amphibious tanks based on Navy amtracs were useful for providing fire support while swimming ashore during the initial landings, but their thin armor drastically reduced their survivability once they reached shore. As a result, conventional tanks fitted with deep-wading kits were still necessary in the Pacific theater to carry the attack inland. This LVT(A)-1 of the US Army's Co. C, 708th Amphibious Tank Battalion was destroyed by a Japanese coastal gun during landings on Yellow Beach-2 on Saipan on June 14, 1944. (NARA)

amtanks remained a standard ingredient in US Army and Marine amphibious landings in Pacific amphibious assaults. However, their lack of armor made it necessary to land conventional tanks in later waves to support the Army and Marine riflemen in the subsequent attacks from the beach. The deep-wading tanks were the standard solution and were used in all the major campaigns of 1944–45.

THE RITCHIE PROJECT

The development of new amphibious tanks in the United States received very little priority in 1942–44, since the Blue Freeze deep-wading kit seemed adequate for most operations and the DD production program took care of the immediate needs of the Normandy landings. However, the US Army General Staff wanted to examine other potential methods for the amphibious landing of tanks, and the project was handed over to a team under Colonel Scott Ritchie of the Research and Development Service, Office of the Chief of Ordnance at Aberdeen Proving Ground. As a result, the amphibious tank effort was dubbed the Ritchie Project. Some of these methods were intended to remedy deficiencies in the Straussler style of swimming tanks, while

The heavy-duty 30-ton booms on the new US Navy attack transports made it possible to use LCM to land tanks even without the use of specialized landing ships. Here, an M4A2 named *Fireball* of Co. B, Marine 4th Tank Battalion is lowered into an LCM from an assault transport on June 18, 1944 for the landings on Saipan. (NARA)

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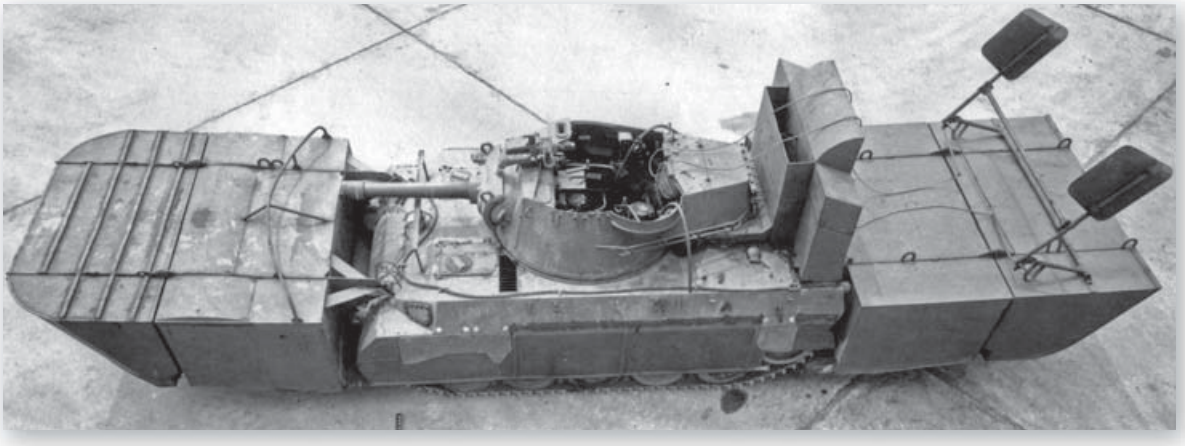
others were aimed to provide simple methods to swim tanks across rivers for the forthcoming campaign in France and Germany.

Although the M3E4 program had been cancelled in 1942, engineers at APG continued to tinker with the concept under the auspices of the Ritchie Project. One of the earliest schemes was called the Yagow Device, based on the name of one of its developers, Lieutenant Yagow. It was also called the DY Device, a contraction of DD Tank and Yagow. This differed from the Straussler Apparatus, since it used mechanical devices to elevate the canvas screen. The basic equipment was completed at APG in late January 1944 and shipped to Firestone for the fabrication of the screen and other components. The tests were successful enough that a preliminary order was placed for 100 conversions. The proliferation of other flotation devices prompted Ordnance to put the DY production on hold and this project never proceeded beyond pilots.

The main effort supported by the Ritchie Project was a secret program to develop a more robust method to land tanks and other armored vehicles using pontoons rather than screens. The initial effort was codenamed the No. 70 Device based on the new T70 (later M18) 76mm Gun Motor Carriage. It was also dubbed the Berg Device after its designer, Major Q. Berg. The pontoons were made of ordinary sheet metal, and filled with blocks of plastic foam wrapped in cellophane to ensure their buoyancy even if the pontoons were punctured by small-arms fire. The Philadelphia Ordnance District was assigned the manufacture of the pilot, which was undertaken by York Safe & Lock Company and the Carrier Corporation. A second aspect of the program was to test whether such a vehicle could be propelled in the water using its tracks rather than a dedicated propeller. Tests were conducted by hoisting an M4A3 tank into the boat slip of Ford's River Rouge plant by an overhead crane. It was discovered that, when connected to a dynamometer, even this simplified propulsion system offered 1,350 pounds of traction in the water; the results could be improved by the use of a specialized track such as extended end connectors. The early tests were favorable enough that on November 29, 1943 Buick began serial production. Components of the Berg Device were first tested at River Rouge on December 29, 1943 and tests of the complete pilot vehicle began in the Delaware river south of Philadelphia in mid-January 1944. These proceeded so successfully that on February 24, 1944 Ordnance recommended procuring 250 kits under the designation T7 Device. This type did not see extensive deployment, as subsequent tests found that the T7 Device suffered



The Berg Device was originally developed to convert the M18 76mm Gun Motor Carriage into an amphibious tank destroyer. This shows the T7 Device attached to a T88 105mm HMC, the assault gun version of the tank destroyer.

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A US Army M4A1 tank was fitted with the T6 Device on Bougainville in late October 1944 for demonstrations to senior commanders in the theater. It is fitted with the full Improved Surfizer kit, as can be seen with the additional waterproofing over the main gun. (NARA)

from low-freeboard that was exacerbated by the open turret of the M18 tank destroyer. Remedies were eventually found for these problems, including the use of canvas covers.

The Berg Device proved successful enough that on January 4, 1944 Ordnance decided to adapt the system to the M4 medium tank. This was first dubbed the No. 4 Device but later renamed the BB Device after its developers, Major Q. Berg and Captain H.F. Blankenship; the BB name was no doubt inspired by the DD tank designation as well. The engineering effort was overseen by Sparkman & Stephens of New York, and 100 kits were ordered from the York Safe & Lock Company even before testing was undertaken. Due to the heavier weight of the BB Device, additional pontoon cells were added on either side of the tank. The first pilot was completed in less than three weeks and a kit was attached to an M4A1 medium tank on January 23, 1944 for trials on the Delaware River near Philadelphia. Although the tests suggested many small improvements, the program was so successful that Ordnance increased the procurement to

E

1: M4A2 MEDIUM TANK, CO. A, MARINE 3RD TANK BATTALION, GUAM, JULY 1944

Although some standardized deep-wading kits had arrived in the Pacific by the summer of 1944 for the landings in the Marianas, some Marine units had to make do with local improvisations. The Marine 3rd Tank Battalion crafted their own deep-wading kits, with the stacks coming from ordinary 55-gallon steel drums. The tank is in the usual olive drab finish and still carries the rampant Marine elephant inherited from the previous I Marine Amphibious Corps Tank Battalion. The tank names followed the company letter.

2: M3A5 MEDIUM TANK, CO. A, 193RD TANK BATTALION, BUTARITARI ISLAND, MAKIN ATOLL, NOVEMBER 20, 1943

The M3 medium tank was used in only one amphibious landing by the US Army, at Makin in November 1943. The landing on the Makin Atoll in the Gilberts was the first use of deep-wading kits in the Pacific. The deep-wading kit is fairly typical of the 1943 configuration with the new "question mark" stacks in a vertical orientation. These stacks had much more prominent flanges and reinforcing ribs than the later kits. The markings on this tank are quite simple, consisting of white national insignia and a blue drab registration number. The battalion insignia was a small yellow triangle with a red square, usually painted about 6 inches in diameter on the front and rear corners.

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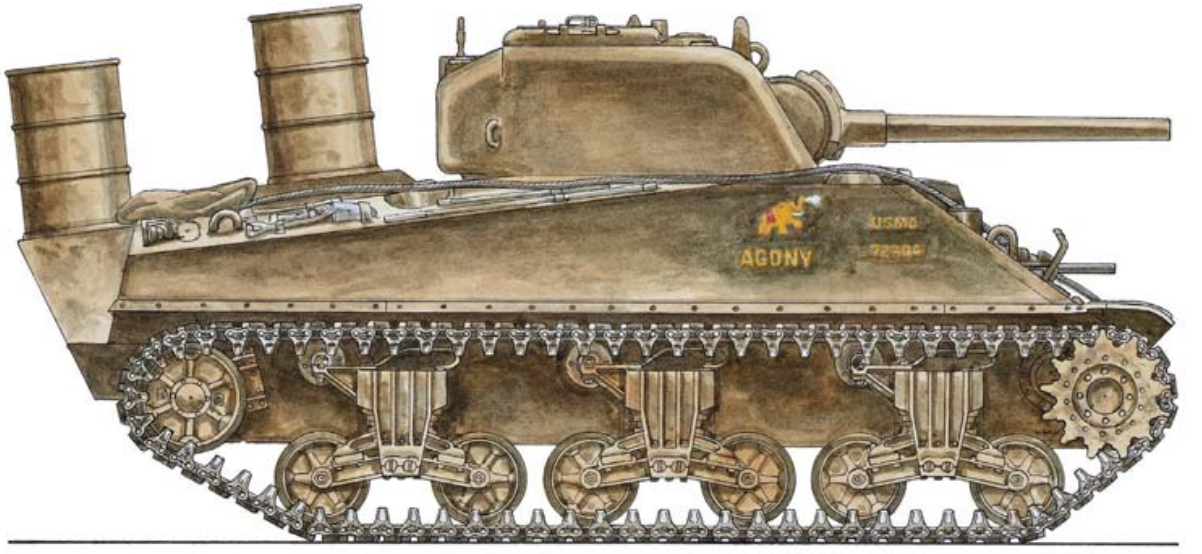

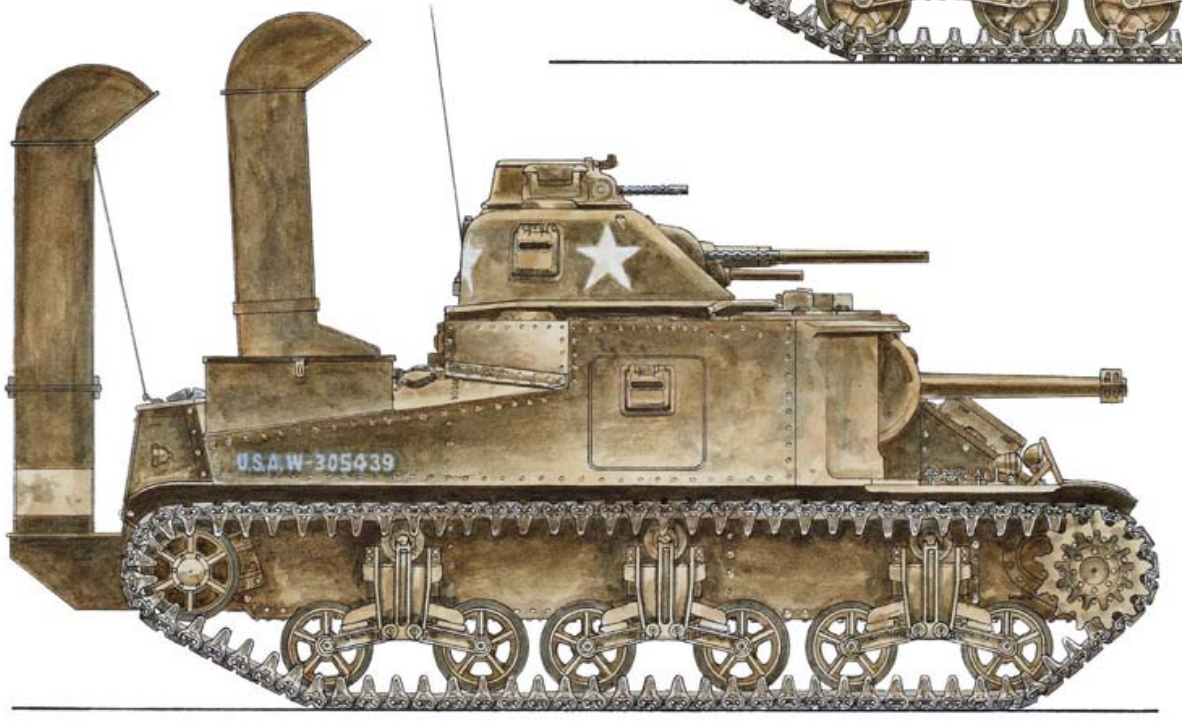

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A T6 Device fitted to a US Army M4A1 medium tank is driven ashore at Bougainville in October 1944. The low clearance of the bow pontoon created problems at Okinawa when some units were confronted by coral reefs off shore. (NARA)

500 BB Devices. The first test of a BB Device from an LST took place in the Chesapeake Bay in February 1944 with many high-ranking officers attending, including the Chief of Naval Operations, Admiral Ernest King. The tank was driven off the ramp at full speed, and the impact with the water collapsed both pontoons upward; the tank sank immediately though the crew managed to escape. This led to a substantial reinforcement of the attachment fittings on the tank hull. Later tests were more successful and by March 1944 the device was considered to be mature enough for demonstrations in England to Eisenhower's SHAEF (Supreme Headquarters Allied Expeditionary Force) staff as well as to British Army tank specialists. Although there was some interest in the device, it was far too late to change the *Overlord* landing plans, and there was far too little room on the LCTs to accommodate the BB Device since it took up the space of two DD tanks. When accepted for production, it was given the experimental designation of T6 Device, and when standardized it was redesignated as the M19 Flotation Device. During the course of T6 Device manufacture some improvements were added. Improved Surfizing Equipment had been developed for deep-wading tanks, and was added to the T6 Device conversion kits. This was a set of improved rubber and canvas covers for the gun and turret ring that allowed the tank gun and tank turret to be operated during amphibious operations.

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The pontoon concept proved successful enough that it was applied to various other armored vehicles. The T7 Device was modified for use on the M5A1 light tank but, when this proved unsatisfactory, attention shifted to the new M24 light tank. Development of a device for the M24 began at Cadillac in May 1944 and the pilot began tests at the end of October. Problems uncovered during the trials led to the construction of a second pilot in December 1944. The program progressed well enough that new production M24 tanks were modified with front and rear adapters to carry the pontoons. However, the war ended before any of these were put to use. In early 1945 the T6 Device was adapted to an M36 90mm GMC tank destroyer but the April 1945 report on the tests recommended against adopting the device in this configuration as the heavy blast of the main gun damaged the front pontoons.

The US Army found that the T6 Device was far more durable than the DD tanks in rough water and much less susceptible to sinking by enemy fire or due to minor damage. One of its main tactical advantages was that a Sherman could fire its 75mm gun during the approach to the beach, which was not possible on the DD tank. The main drawback was the size of the device: while an LCT could carry four DD tanks, they could only carry two T6 Devices. The recommended transport was the LST, which could carry and launch six T6 Devices plus an LVT amtrac, which was used as a guide vehicle. There was a greater abundance of assault transport in the Pacific theater by late 1944 when the device began to be deployed, so the size issue was less critical than during the Normandy landings. In October 1944 a demonstration was held on Bougainville to acquaint Army and Marine officers with the new device, and it was earmarked for its combat debut during the Okinawa landings.

THE T6 DEVICE AT OKINAWA

During the planning for the Operation *Iceberg* landings on Okinawa in the spring of 1945, the Army and Marines decided to test the T6 Device prior to using it in large numbers during the anticipated Operation *Downfall* landings on the Japanese Home Islands later in 1945 and in 1946. A special technical team under Captain Floyd Coleman departed Aberdeen Proving Ground in December 1944 to Guadalcanal to train the US Army and Marine Corps units on the use of the T6 Device and to supervise the attachment of the kits on their tanks. Two Marine tank battalions were assigned the device, the 1st and 6th Tank Battalions. The Army's 20th Armored Group intended to land three tank companies with the T6 Device, one each from the 193rd, 711th, and 763rd Tank Battalions. In the event, the 763rd landed with deep-wading trunks and the 193rd Tank Battalion remained in reserve until April 8, and so had no need for the T6 Devices.

On April 1, 1945 Company B, 711th Tank Battalion launched a dozen T6 Devices from six LSMs from a range of about 500 yards from shore as part of the 9th Wave. They landed on Beach Orange, west of Kadena airbase, without any damage and a few minutes later were followed by deep-wading tanks of Company A from LCM-6 landing craft. The Army was not especially impressed with the T6 Device and the after-action report concluded that "the T6 flotation devices were not considered very satisfactory due to their small angles of approach and departure. Difficulty was experienced in crossing the reef when the front pontoon struck the reef and prevented the tracks from getting a firm footing."

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The Marine 6th Tank Battalion deployed its dozen T6 Devices in test platoons from Companies A and B. Curiously enough, the Marines considered the T6 Device to be buoyant enough to accommodate a dozer blade, and at least one of the tanks landing on Okinawa was fitted as a dozer tank. The 6th Tank Battalion M4A3 tanks with the T6 Device were launched without problem and made it to the beach west of Yonton airbase, surmounting the coral reef without incident and landing at H+29.

The Marine 1st Tank Battalion landings on Okinawa proved the most frustrating. The battalion's six M4A2 tanks with T6 Devices were deployed with 1st and 2nd Platoons, Company C, and were transported to Okinawa aboard LST-628, along with a single LVT amtrac to serve as a guide vehicle. Although the tanks were scheduled to be launched at H+20, the ship commander refused to launch them without direct orders from a higher command. After considerable argument with the Marines on board, the tanks were finally launched at H+60, but from a location 10 miles from shore instead of the intended line of departure. It took the tanks five hours to swim the distance. A US destroyer inadvertently got into the path of the T6 commanded by Sergeant D.I. Bahde, which rammed the destroyer on its side, probably the only instance of a warship being rammed at sea by a tank. Although the warship escaped any damage, the T6 was not so fortunate and its pontoons began to leak. The tank continued to chug slowly towards the landing beach but sank near shore after it ran out of fuel for its bilge pump.

The Okinawa landings proved the technical feasibility of the T6 Device, though it raised questions about the tactical necessity. Japanese tactical doctrine had changed since the Tarawa landings in 1943, moving away from a violent defense of the beach to a new doctrine favoring defense away from the beach. Nevertheless, there was strong evidence that the Japanese were preparing extensive beach defenses on Kyushu, the first of the Japanese Home Islands scheduled to be assaulted later in 1945. As a result, both the US Army and Marine Corps planned to make extensive use of the T6 Device in these amphibious landings. The slogan for the Ritchie Project became "The Army will come out of the sea and crush Japan!"

In July 1944 a program was initiated to develop the T8 Device for the T26E1 heavy tank. Construction of a pilot began on September 1, 1944 but was delayed due to the switch from the T26E1 to T26E3 tank and the lessons from the Okinawa campaign. Changes were made in the configuration of the T8 Device, with the angle of the bow pontoon increased to provide more clearance when crossing reefs. As a result the first pilot was completed at APG on April 25, 1946, following the end of the war. Pontoon devices were developed for the M46 and M47 tanks in the late 1940s and early 1950s such as the T15 Device.

F

T6 DEVICE, MARINE 6TH TANK BATTALION, OPERATION *ICEBERG*, OKINAWA, APRIL 1, 1945

The T6 Device tanks were finished in the usual overall olive drab and insignia consisted of a white star marking on the left forward corner of the turret roof. The battalion had an elaborate markings scheme. Platoons were identified by geometric shapes: square (1st), circle (2nd), diamond (3rd), and triangle (4th); headquarter elements had their own symbols including a heart for the battalion HQ company, and a shamrock for the company HQ. Each company was assigned a color for these markings: red (Co. A), white (Co. B), and yellow (Co. C). On the T6 Device, these markings were usually painted on the side pontoons in the middle.

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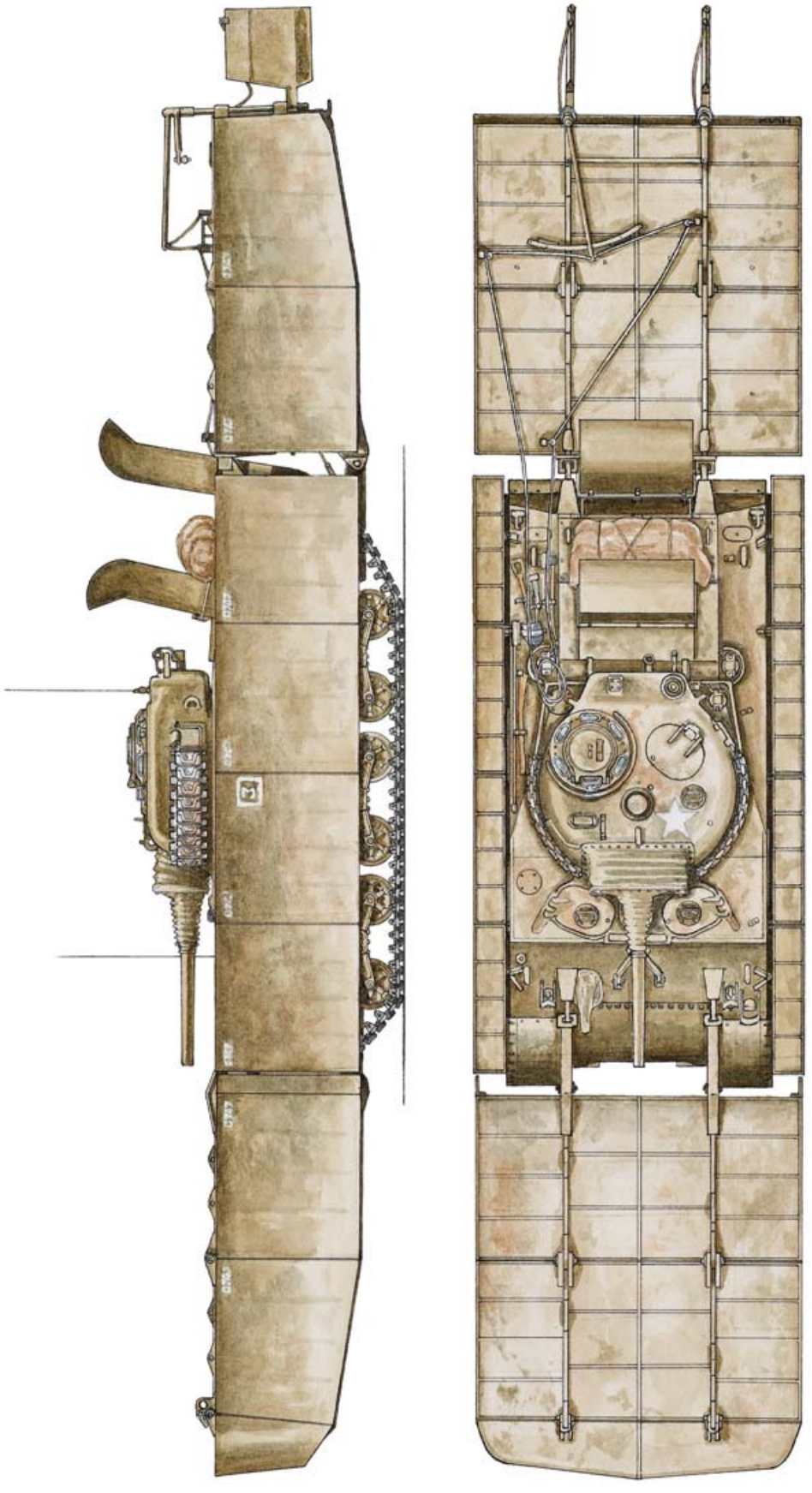

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RIVER-CROSSING TANKS

OPPOSITE TOP
The most successful of the Ritchie Project river-crossing kits was the T12, which added a pair of engineer 15-ton pontoons to either side of a Sherman tank by means of a simple saddle.

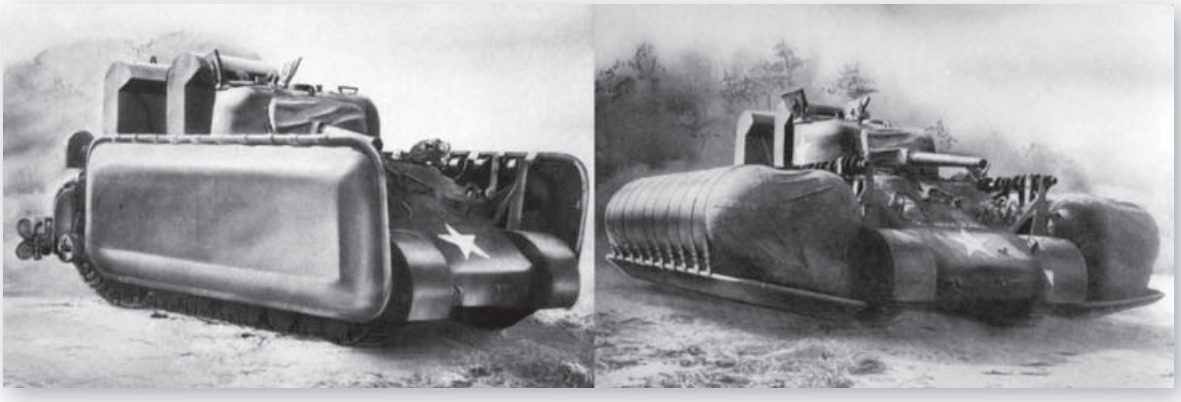
OPPOSITE BOTTOM
One of the more curious river-crossing methods was the use of two DUKW amphibious trucks with an M4A1 medium tank suspended between as a "DUKW Wet Ferry." Although feasible, this system was never used in combat.

Besides examining flotation kits for amphibious landings at sea, the Ritchie Project also developed a number of other devices intended primarily for river-crossing operations. There were at least three attempts to adapt inflatable pontoons to float tanks. The Blakenship Device attached a set of inflatable pontoons to the side and front of an M4 medium tank by means of a set of overhead rails; propulsion came from a pair of outboard motors. Tests of the Blakenship Device in the spring of 1944 were favorable enough that Ordnance judged it suitable for river-crossing operations. The Hale Device was a cooperative effort between APG and Firestone, and consisted of two inflatable pontoons attached to the side of an M4 medium tank inside a metal shell. To operate the device, the outer shell was folded down and the rubber pontoons inside inflated using air bled off the engine exhaust. Propulsion in water was accomplished by a set of propellers on both rear corners that were powered off the tank engine. The device added about 3½ tons to the weight of the vehicle. Two different pilots were completed in early 1944 but problems with lateral stability discouraged further development.

The Corps of Engineers proposed a kit that allowed two standard 15-ton inflatable rubber pontoons to be attached to either side of an M4 tank. A pair of 22hp outboard motors was attached to the rear for propulsion. This project proved promising enough that a small number of kits were manufactured as the T12 Pontoon Device, and a few were shipped to Britain for demonstration purposes. Later tests included the use of the 18-ton engineer pontoon on both the M4 medium tanks and T25/T26 heavy tanks. Development continued after the war, but testing concluded that the existing T12 configuration was unsatisfactory due to the complexity of its construction and its failure to jettison properly during tests. One of the most curious ideas for a river-crossing tank was another Corps of Engineers project called the DUKW Wet Ferry. It consisted of a simple kit that allowed a pair of DUKW amphibious trucks to be attached to either side of an M4 medium tank. This combination proved viable in calm river and lake conditions with waves up to 2 feet high. Neither the T12 nor DUKW Wet Ferry was ever used in combat.

No dedicated kits for river crossing were available in the ETO in early 1945 during the campaigns along the Roer and Rhine rivers. In expectation that specialized equipment would be needed, the AFV & Weapons Section of SHAEF began collecting the scattered remnants of the Normandy

The Hale Device consisted of a pair of pontoons held in a container on the side of the tank as seen at the left, which could then be inflated for river crossings as seen on the right. Propulsion was by means of outboard motors.



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ABOVE LEFT
An M4A1 DD tank of the 748th Tank Battalion with Patton's Third US Army near Braunshorn on March 24, 1945 during the Rhine-crossing operations showing the propellers folded up in travel position. This particular tank has extended end connectors fitted to the track, and also has been modernized by the substitution of an all-around vision cupola instead of the usual split commander's hatch. (NARA)

ABOVE RIGHT
The US Army transported a number of LCM to the west bank of the Rhine in early 1945 to support the river-crossing operations. Here, an M4A1(76mm) is seen in the Ninth US Army sector during the river-crossing operations. (NARA)

DD tank fleet in November 1944. There were only 118 M4A1 DDs of the original 268 still available in US Army hands, since most of those used on D-Day had their skirts and specialized equipment removed and were then used as ordinary tanks. British DDs were supplied to the US Army to make up for shortfalls. These included both the Sherman III (M4A2) and Sherman V (M4A4) DD tanks; a small number of the Valentine DD tanks were provided for training. Several tank battalions had special amphibious platoons trained in the operation of the DD Tank. In the event, far fewer DD tanks were used for the Rhine crossing than originally anticipated. Company C, 736th Tank Battalion with the Ninth US Army crossed the Rhine on 23–24 March 1945, mostly equipped with British M4A2 DD tanks but with a few M4A1 DD tanks as well. The 748th Tank Battalion had 51 DD tanks, but a long road march to the Rhine damaged the specialized equipment and only 18 were able to float. Eight were launched across the Rhine near Oppenheim on 23–24 March 1945, with one sinking; ten more were ferried across. This was the last time that the DD tanks were used in an amphibious role during the war, though they continued to serve as normal gun tanks with their skirts removed. Instead of DD tanks, most units used other means. The US Army moved a number of LCM landing craft to the Rhine and these were used to ferry tanks across. Since they were not large enough to accommodate the new T26E3 tank, pontoon rafts were created instead.

FURTHER READING

This is the first book dealing with US amphibious tanks in World War II, so it is based primarily on unpublished archival sources. The developmental history is based on Ordnance records at the US National Archives and Records Administration at College Park, Maryland. The author also used numerous after-action reports by US Army and Marine tank battalions that saw combat with the DD tank, T6 Device, and other amphibious assault equipment.

G

T6 DEVICE, MARINE 6TH TANK BATTALION, OPERATION *ICEBERG*, RED BEACH-1, OKINAWA, APRIL 1, 1945

The experimental platoon of the Marine 6th Tank Battalion landed from LST-125 off the Okinawa coast.

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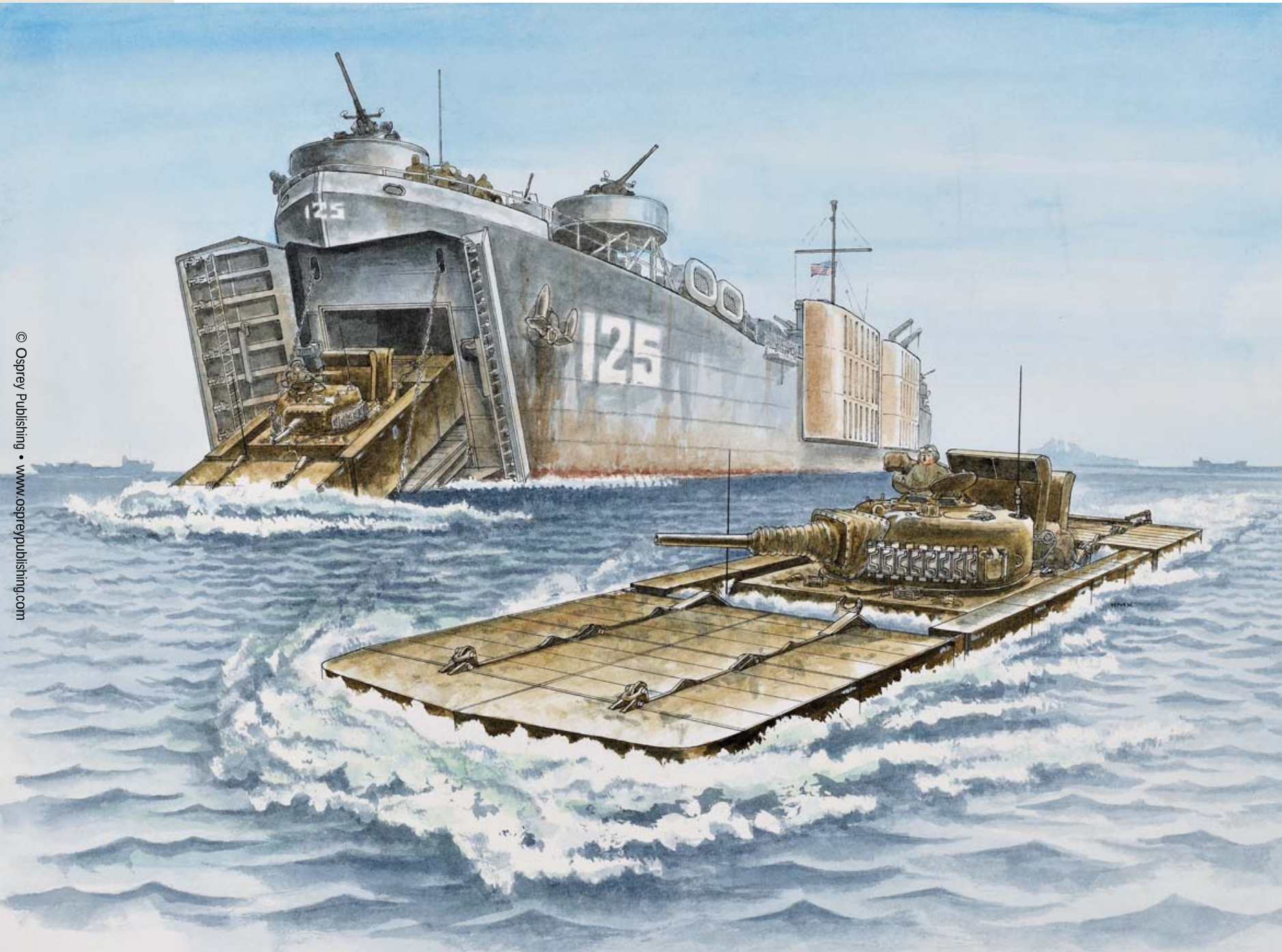

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OSPREY
PUBLISHING

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First published in Great Britain in 2012 by Osprey Publishing,
Midland House, West Way, Botley, Oxford, OX2 0PH, UK
44–02 23rd St, Suite 219, Long Island City, NY 11101, USA
E-mail: info@ospreypublishing.com

Osprey Publishing is part of the Osprey Group

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A CIP catalog record for this book is available from the British Library

Print ISBN: 978 1 84908 636 3
PDF e-book ISBN: 978 1 84908 637 0
EPUB e-book ISBN: 978 1 78096 877 3

Page layout by The Black Spot
Index by Sharon Redmayne
Typeset in Sabon and Myriad Pro
Originated by PDQ Media, Bungay, UK
Printed in China through Worldprint Ltd.

12 13 14 15 16 10 9 8 7 6 5 4 3 2 1

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AUTHOR'S NOTE

The author would especially like to thank Joe DeMarco for his generous help on this project.